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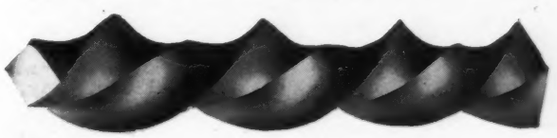

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The S-A Page

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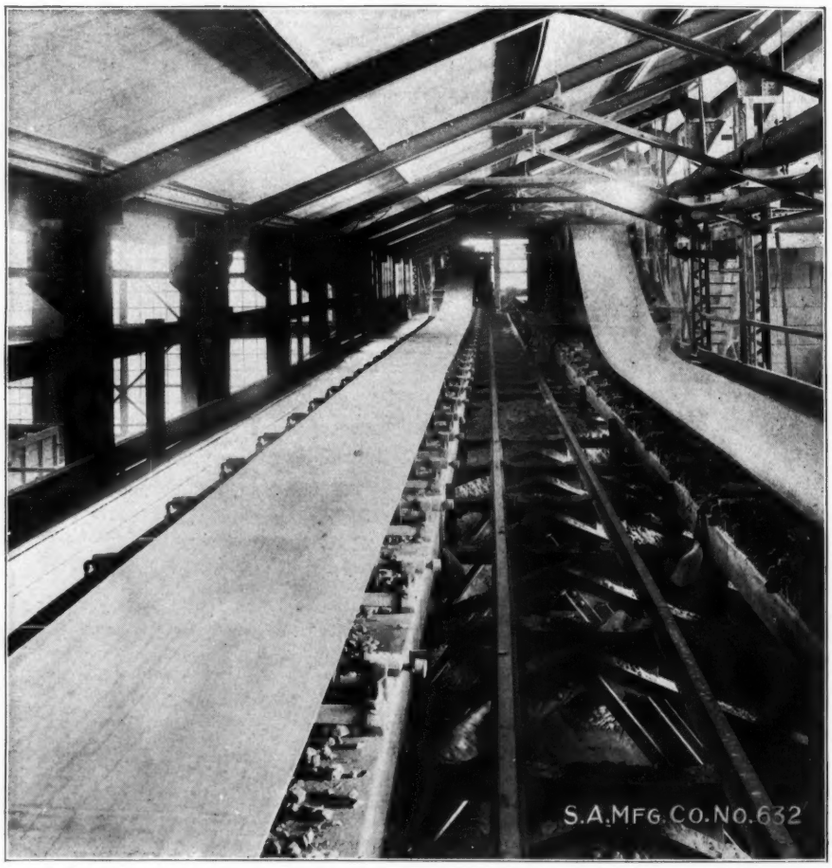

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Mining Journal

VOLUME 101 MARCH 11, 1916 NUMBER 11

Operations in the Slocan District

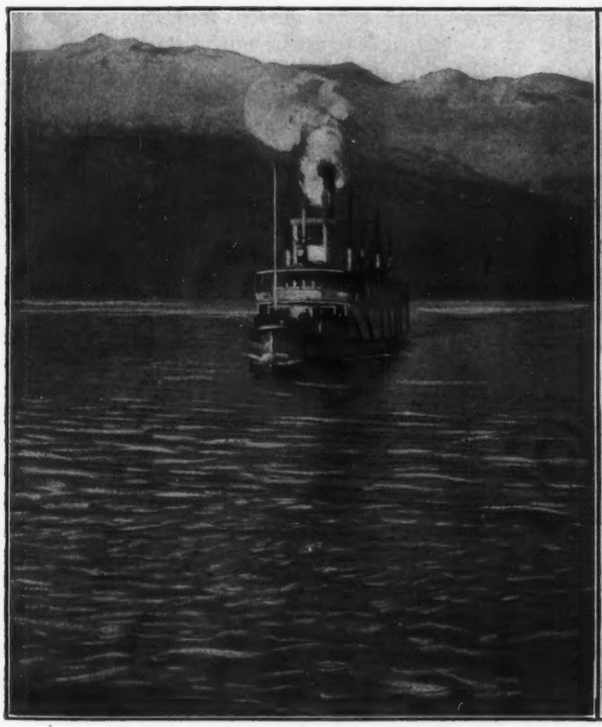
By Douglas Lay*

SYNOPSIS—General observations on the character of the Slocan ores and milling practices are supplemented by a description of the Van-Roi mill. Finally, suggestions are made on the points requiring elaboration to perfect the practice.

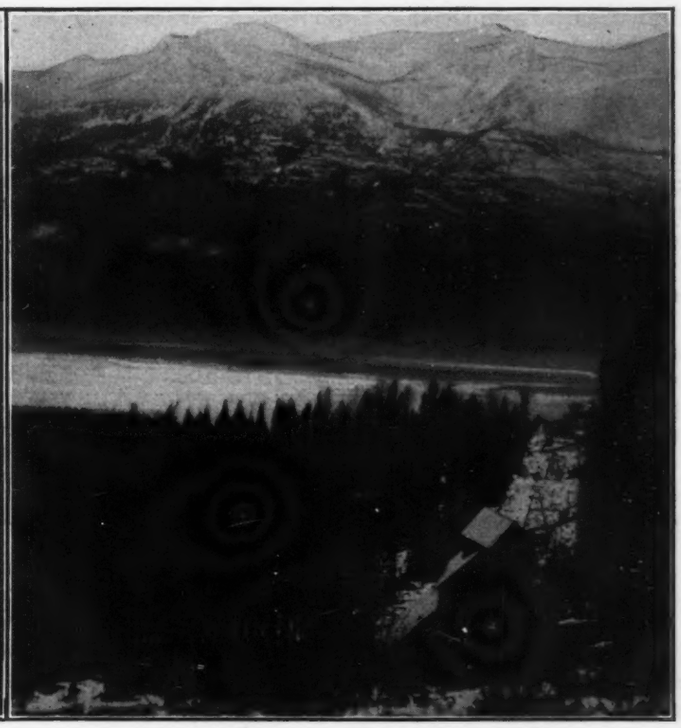
Water concentration in the Slocan district, British Columbia, is of interest because of the means adopted for saving ruby silver and gray copper. It may be stated that expansion of the milling system has been much impeded in the past by the apparent varying nature of the orebodies and the poor price received for zinc concentrates. In such circumstances directors, unable to be assured of any large tonnage of ore in sight, have been apt to deem that the interests of shareholders were best conserved by confining concentrators to roughing machines with low running costs and comparatively poor metallurgical savings. In consequence the reputation of the technical men has suffered because visiting engineers have failed to appreciate the value of the silver-saving devices and have been apt to blame the millman for low zinc savings. In many cases it has been clearly seen that, by expansion better metallurgical savings would result, but funds have not been available for the necessary initial outlay.

However, the results of the more systematic and courageous underground development followed by various mining companies during the last few years warrant the belief that much of the apparent "bunchiness" of Slocan orebodies in the past has been due to lack of development. The more recent mining developments have given a distinct stimulus to milling methods, and no doubt the future will see still further milling expansion.

Slocan ores consist mainly of galena, blende, siderite and pyrite in a gangue of quartz and slate. The mixture is frequently intimate. Silver exists not only in chemical combination in the galena and blende, but also in the form of ruby silver and with gray copper—less frequently as native. It is important to note that the gray copper usually occurs in the galena like currants in a pudding and that the ruby silver usually occurs in cleavages and is most frequently found in an association of the minerals galena, blende and siderite. Native silver usually occurs in or on the galena. As a general rule the rich silver



SLOCAN LAKE, BRITISH COLUMBIA



STANDARD SILVER-LEAD MINING CO.'S MILL

*Mining engineer, 12 Westbourne Road, Forest Hill, London.

minerals exist in immediate proximity to galena or blende and do not occur isolated in the quartz or slate. It is important to take particular notice of this association, because upon it depends the ability to make a respectable saving of these rich silver minerals by a process of water concentration. The ores may be divided into two broad classes—those amenable to water concentration and those not amenable to it mainly by reason of the large amount of siderite present. Siderite and blende being of almost the same specific gravity, it follows that they are not completely separable by water concentration. In this class also fall certain intimate mixtures of minerals—galenas, for instance, which appear to be a kind of concrete formed of comminuted slate and galena proper. In ores of this class flotation would appear to offer a solution of the milling problem. At present there is only one flotation plant in the district—that of the Silverton Mines, Ltd., which has been in operation for about 18 months.

Prior to 1902 there was no market for zinc ores or concentrates in the district, consequently the old mills were lead mills proper, making respectable lead savings but poor silver savings, since much of the latter was contained in the zinc that was purposely run into the tailings. Slocan lead concentrates, it may be noted, carry between 2 and 4 oz. of silver per unit of lead; Slocan zinc concentrates carry from 1 to 2 oz. of silver per unit of zinc. When zinc concentrates became marketable, mills were modified somewhat, to save a certain amount of zinc, but, as has been mentioned, ore reserves were in most cases not such as to warrant any heavy initial outlay in the mills.

Recent underground development has cast rather a different complexion on the matter, in addition to which there has been an enormous increase in the price of zinc since the commencement of the War. In consequence operators are realizing the advisability of "getting after" the tailings in earnest.

A detailed account of one of the most recent mills, that of the Van-Roi Mining Co., Ltd., is given because it is illustrative of a compromise between the old type of lead mill and a plant aiming at high zinc recovery. Moreover, an analysis of the results obtained throws much light upon the question of further milling expansion and the successful treatment of the district ores generally.

Incidentally it may be mentioned that, before constructing this mill, the Van-Roi Mining Co. milled its ore for some years in a rented mill, so that valuable data were available at the time of erection of their own mill.

The Van-Roi Mill as an Example

The cars of milling ore are dumped over large grizzlies at the upper terminal of an aërial tram. The bars of the grizzlies are 2 in. apart. At this point all coarse waste is sorted out, likewise any coarse pieces of "clean" ore and also any association of minerals known to carry high silver values, likely to suffer milling loss—for example, lead-middling products rich in ruby, and quartz or slate showing ruby. Milling ore is conveyed by aërial tram to the mill, at which point it is weighed before being dumped into the bin.

Reference to the accompanying flow sheet will furnish such supplemental data as are not evident from the following description:

The weighed ore from the storage bin passes over a grizzly with bars 1½ in. apart. The undersize passes to the feed bin direct, and the oversize is crushed in a 9x15-in. Blake crusher over the feed bin. From the feed bin the ore passes to a set of 12x36-in. feed rolls, thence to the boot of the elevator, whence it is elevated to the trommel system.

There are three trommels, of which the two coarsest have two sections each. The screen sizes are 16 mm., 10 mm., 7 mm., 4 mm. and 3 mm. All material below 4 mm. passes to an upward-current hydraulic classifier that separates the feed for 4 five-compartment jigs.

Overflow from the classifier passes to a long V-shaped settler feeding 7 Wilfley tables. There are in all nine jigs, all of the Harz type. Three sets of 12x36-in. rolls serve for regrinding the middlings products. Concentrate bins are on the bottom floor of the mill—lead bins on one side and zinc bins on the other. Both lead and zinc bins are in duplicate, so that discharge can take place in one while the content of the other is being disposed of. Water overflowing from the concentrate bins passes through long settling tanks, of which there are two, one for lead, the other for zinc.

Metallurgical Features of the Mill

There is a three-compartment oversize jig, the main justification for which is the protection it affords to the machinery from the miscellaneous assortment of hardware and bits of wood that a mine usually delivers to a mill along with the ore. The objectionable material is culled out by the oversize jig before it has had much opportunity for damaging the machinery. The objection to an oversize jig is that, the sizing not being close, the jig does indifferent work from a milling standpoint. In this particular instance the objection is minimized by making the oversize jig of three compartments, thus permitting a heavy withdrawal of middlings from the second and third compartments and so protecting the tailings. In fact, little or no tailings need be made on this jig should this course be warranted by the feed.

The cup discharge from the first compartments of the oversize and the 16-mm. to 10-mm. jigs goes to the lead-concentrates bin. Cup discharges from the second and third compartments of these jigs are middlings and are reground for further treatment. The hutch product from all compartments of these jigs is middlings. In all the jigs, as a general rule, first-compartment cup and hutch products go to the lead-concentrates bin. Second-compartment cup and hutch products are middlings and are reground. Third-compartment cup and hutch products go to the zinc-concentrates bin. Fourth-compartment cup and hutch products are middlings and are reground. It is not always possible, owing to the changing nature of the feed, to make zinc concentrates on all these jigs. Indeed, at times it may not be possible to make zinc on any of them, owing to the intimate association of minerals. To meet this, spouting is so arranged that the third-compartment products can be diverted either into the zinc-concentrates bin or to middlings for regrinding.

It may be noted that lead in lead concentrates is penalized by the smelter if it falls below 70%, likewise zinc in the lead concentrates if it exceeds 8%. In the case of zinc concentrates zinc below 45% is heavily penalized, consequently in the Slocan it is not advisable to produce lead concentrates much below 60% lead or zinc concentrates below 40% zinc. In the latter case the aim is to

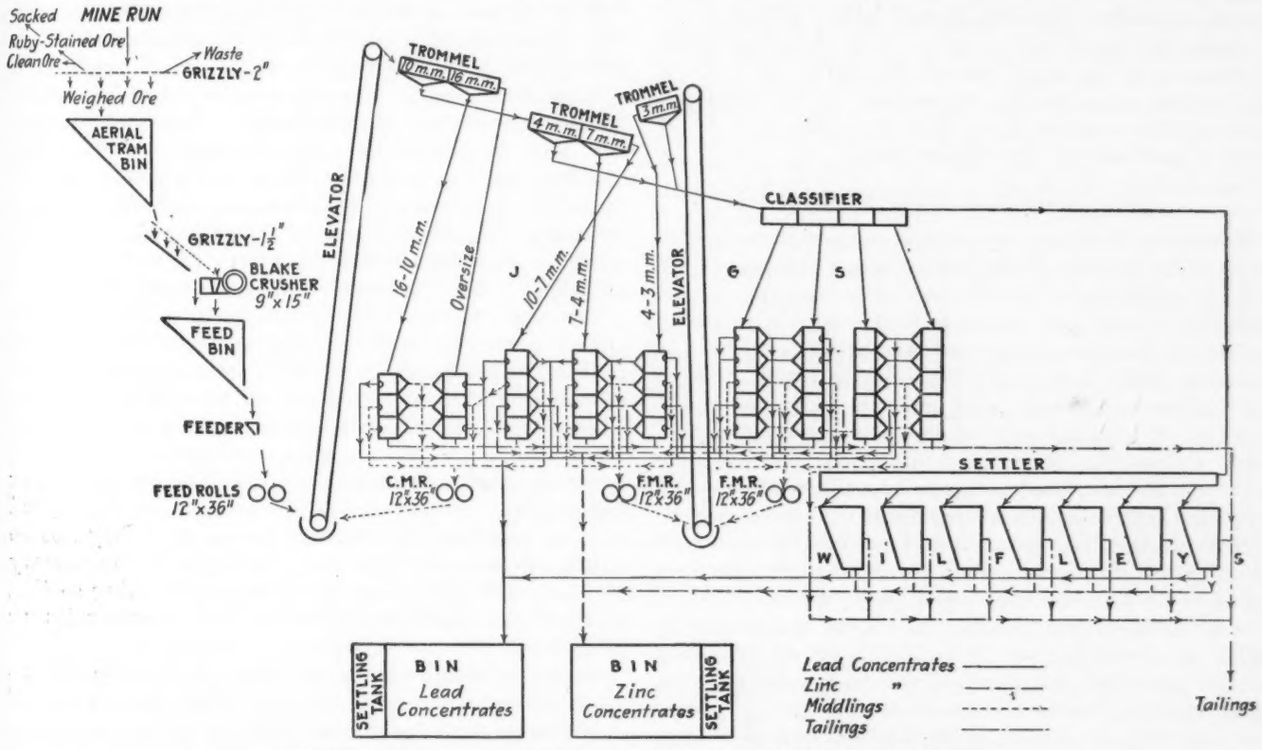
produce zinc concentrates as near 45% zinc as practicable. Thus it will be noted that tailings have to be kept down and at the same time high-grade concentrates have to be produced.

Coarse concentrates, both lead and zinc, assay much higher in silver than the corresponding fine concentrates. For instance, Van-Roi classifier-jig zinc assays about 45 oz. of silver per ton, while zinc concentrates from the 10-mm. to 7-mm. jig assay about double this in silver. It was formerly customary in the Van-Roi mill to make no zinc concentrates save on the classifier jigs, the idea being to keep the zinc grade of the zinc concentrates as high as possible. In view of the fact that at the time the zinc concentrates were running unusually high in silver, it was decided to make coarser zinc concentrates, anticipating that this would enhance the silver saving. The coarse end of the mill was accordingly remodeled to conform with the present flow sheet. The effect of the change was markedly beneficial, and not only were silver savings greatly improved, but also zinc savings. It was also most conclusively proved that whether the general silver grade of the zinc concentrates was much above or much below the average, the coarse zinc concentrates assayed in silver nearly twice as much as the fine zinc concentrates. It is interesting to note that better metallurgical results, increased capacity and therefore lower running costs were brought about in this case not by finer, but by coarser crushing. These results also demonstrate that in the case of Slocan ores the question of crushing must be closely studied in connection with its effect on silver savings.

In a mill, such as the Van-Roi, in which no attempt is made to re-treat coarse jig tailings, percentage savings are to a great extent dependent upon the grade of the feed. As a general rule the richer the feed the higher the percentage savings, inasmuch as tailings, by the means effected, cannot be brought below a certain irreducible minimum, which remains more or less constant regardless of the feed. Savings average 80 to 85% of the lead, 40 to 60% of the zinc, and close to 80% of the silver, the highest silver saving recorded in any one month being 83%.

Mechanical Features of Van-Roi Mill

The mill is operated by water power, there being four Pelton wheels operating under a 600-ft. head. A 75-hp. wheel supplies the main power in the mill, driving the rolls, elevators, and jigs. A 25-hp. wheel operates the crusher, a 10-hp. wheel the Wilfley tables and another 10-hp. wheel drives a dynamo for lighting purposes. The idea of having several power units is to prevent undue absorptions of power affecting the speed of the mill as a whole. Large speed indicators, showing respectively the speed of the Wilfley tables and of the main mill shaft, are placed in a conspicuous position, so that millmen can see at a glance whether the speed is correct or not and make regulation accordingly.



FLOW SHEET OF THE VAN-ROI MILL IN THE SLOCAN DISTRICT

The four sets of rolls are of the same size and type, so that all spare parts except feed-roll shells are interchangeable. Feed-roll shells are, as has been mentioned, manganese steel; middling-roll shells are chrome steel. In addition to a spare set of shafts and cores for the feed rolls, one other spare set is kept, which is interchangeable with any one of the other three sets of rolls, in order to save time when it is necessary to change shells.

While each particular ore requires special study, it is possible to indicate broadly what lines should be followed as a general rule in order to improve savings. Much light is cast upon the matter by a study in existing mills of the extent to which the individual jigs and other machines figure as tailings producers. It is not sufficient to know merely the assay value of the tailings made by

each individual machine; there must also be ascertained the proportion of the total tailings that each machine makes. The latter is of course obtained by weighing the tailings produced in a given time. An investigation along these lines in Slocan mills discloses some interesting facts. First, Slocan feeds average about 10 to 20 oz. silver per ton, about 5% lead and 7 to 15% zinc. The coarse jigs invariably make the cleanest tailings. These will assay about 3 oz. silver, 0.5 to 1% lead and 3% zinc, whereas classifier-jig tails will run probably 5 to 6% zinc, as will also the Wilfley tailings. This fact, which does not appear to have received the attention it merits, is due to two causes: First, the coarse jigs derive most of their feed from straight ore, which is not so rich in mineral contents as the feed of the classifier jigs, which consists largely of reground middling products, affording a feed not only richer in mineral contents but also more complex; second, coarse jigs operate on sized material, whereas classifier jigs treat equally falling particles.

About 70%, by weight, of the entire tailings is produced by three or at the most four of the coarse jigs. About 20% of the entire tailings is produced by the remaining ones and the classifier jigs, while the balance, of about 10%, is produced by the Wilfley tables.

Problem of Regrinding Tailings

It follows, therefore, that whatever improvements may result from expanding and improving the fine part of the milling system (such as has been done recently by the Standard Silver-Lead Mining Co.) and by replacing hydraulic classifiers by screens of the Callow type for instance, such improvements still leave about 70% of the tailings unaffected. Any material reduction in the assay of the tailings as a whole cannot, therefore, take place unless the 70% of tailings—the coarsest—are reground and retreated. Regrinding these tailings and treating them with the existing plant cannot be contemplated. In the first place it would enormously reduce the capacity of the plant and correspondingly increase milling costs, and in the second place it is doubtful if cleaner tailings would result, the reason being that the effect of regrinding would be to throw an enormous burden upon the classifier jigs, which, not operating on sized material, cannot be crowded. To give a specific instance: On one occasion at the Van-Roi mill all tailings from the two coarsest jigs were reground and passed again to the trommel system. The result was the tailings ran somewhat higher than under the normal conditions, doubtless for the reasons given.

Inasmuch as no high silver savings by water concentration can be made on Slocan ores without a preliminary system of coarse concentration, owing to the prevalence of ruby silver and gray copper, it would appear that to make really close savings virtually two mills are required: First, a plant embodying the principles of coarse concentration, in which sufficient attention is paid at the same time to the fines section to result in a total saving of, say, 80% to 85% of the lead, 40% to 60% of the zinc and 75% to 80% of the silver; second, a mill treating the tailings produced by the first mill. This would involve grinding to, say, 30 mesh and then employing water-concentration methods or flotation. It remains to be proved whether water concentration or flotation would yield the best results, metallurgically and financially, in a mill of this kind. The efficacy of the Dorr settler as a saver of fine slimes has been demonstrated in one case and has given a stimulus to water concentration of fines. On the other hand, in cases where much siderite is present, the advantage would lie with flotation.

One thing is certain: Before there could be any serious talk of a mill for re-treating tailings, there would have to be substantial ore reserves. Again, the financial efficiency of a mill of this kind would depend to a great extent upon the state of the zinc market. Bearing in mind the various circumstances likely to affect the Slocan operator, suggestions likely to be of most practical use will be those the adoption of which would be practically certain to increase the savings made by a process of more or less coarse concentration.

Improving the Zinc Concentrates

While the importance of making coarse lead concentrates with a view to enhancing silver savings has been fully recognized in the district, the same policy has not been followed in connection with zinc concentrates. Every effort should be made to make as much coarse zinc as possible, having in view the necessary zinc minimum, before the classifier jigs are reached. This will increase not only the silver, but also the zinc saving. This objective necessitates closer sizing at the coarse end of the mill. The coarsest jigs, especially the oversize ones, must have not less than three compartments, otherwise tailings cannot be adequately protected by withdrawal of middlings. Zinc jigs will require four compartments.

The replacement of hydraulic classifiers by screens is almost certain to cause the jigs to make much cleaner tailings. Incidentally a great dilution of pulp will be thereby avoided. Attention was drawn to this matter by Philip Argall in 1905. It should be borne in mind that Slocan feeds are apt to change suddenly in character. Spouting must be arranged to meet these changes. For instance, on one day it may be possible to make good zinc on a certain jig; the day following it may not be possible to make any zinc on the same jig. The necessary elasticity will be obtained by arranging spouting so that products can be diverted either into concentrates or middlings.

Attention is called to the fact that the finer the concentrates the more moisture they will hold. In the case of zinc concentrates freight and haulage charges are based upon the moist weight. It is necessary to partly dry fine concentrates before shipment, to avoid excessive freight charges. The coarser the zinc concentrates produced the less the moisture and the less the freight rate. In the case of the Van-Roi concentrates, by making coarse zinc the moisture contents dropped about five units (from 8% to 3%) representing a gain of approximately 60c. per ton of concentrates produced for freight and haulage charges alone.

Moisture in lead concentrates affects the hauling charge alone, inasmuch as a combined freight and treatment rate is quoted for this product based upon the dry weight. It is interesting to note that fine lead concentrates resulting from settlement of the overflow water from the concentrate bins invariably run much lower in silver than the average lead concentrates.

Undoubtedly it is desirable to sort out coarse waste, say over 2 in., by hand prior to milling. This coarse waste is usually extremely hard and causes the greatest wear and tear on the milling machinery.

As to sorting out clean ore, if the advantage lies with sorting out rather than milling, it is only by a very slender margin. The arguments of the advocates of sorting out clean ore are open to question, because it is assumed that the ore that is sorted out would, if milled be exposed to the average lead loss of the particular mill under consideration. For instance, assuming an average saving by concentration of 75% lead, the premise is adopted that of every ton of lead ore that goes through the mill, only three-quarters of a ton is saved in the form of concentrates; then follow deductions from this premise.

The Question of Specific Savings

Now we are not concerned with average savings, but with savings in a particular instance. The question is not what happens to the average lead ore going through the mill, but what happens to the particular class of lead ore that is picked out. This particular lead ore is essentially clean ore, or it would not be picked out by the sorter. That is to say, it is essentially a first-compartment jig product. If allowed to go through the mill, the great majority of it would be caught on the first compartment of the oversize or coarsest jig and delivered to the concentrate bin. The balance might be fine and as such be delivered to fine jigs; at the same time it would still be a first-compartment product and, as such, exposed to no regrinding losses. Even if it is assumed that all clean ore flies into small fragments as soon as it touches the crusher or feed rolls, these small fragments are not middlings products exposed to regrinding, but first-compartment products and, as such, exposed to no such losses.

If in any particular mill the average lead saving is 75%, then the saving of that portion of the lead existing in the ore as a middling product will be considerably less than 75%, and the saving of that portion of the lead existing in the form of clean ore—that is, as a first-compartment product—will be considerably more than 75%. It is safe to say that if the clean lead ore, instead of being picked out, is allowed to go through the mill, not less than 95% of it ought to be, and in the great majority of cases is, recovered as concentrate. This class of material is, strictly speaking, not milled at all. It merely goes through the crusher and one set of coarse feed rolls and is exposed to no fine crushing whatsoever; consequently there can be no appreciable loss in the process.

In the case of Slocan ores it would appear far more logical to pick out those coarse lead-middlings products, that show ruby silver or gray copper and that are known to be of high silver content, rather than pieces of clean ore.

Further, if material amounts of clean lead ore can be picked out of the mill feed, it is a question if it would not be as good practice to open up the feed rolls and adopt coarser jigging, as to elaborate the sorting system.

Mine Accidents in Idaho

The total number of men employed in the mining industry of Idaho during 1915, according to Robert N. Bell, state inspector of mines, in his seventeenth annual report, at times reached 7,500 men and would probably average 6,500. The number of fatal accidents per thousand men employed was 3.54, as compared with 5.19 in 1914.

During the year there were reported a total of 23 fatal accidents, whose causes fall under the following classifications: Fall of rock or ore from roof or wall, 9; explosives, premature blasts, etc., 3; haulage by mine car, mine locomotive, 24; falling down chute, winze, raise or stope, 1; electricity, 2; suffocation from powder and other gases, 3; shaft accidents, 0; mill accidents, 1; total, 23.

Mine-Accident Statistics and Prevention

A convention of state mine inspectors and representatives of industrial compensation commissions, which was the result of an invitation issued by the Secretary of the Interior to the Governors of the various states, was held in Washington, Feb. 24 and 25. There were 30 state and Federal officials present in addition to a large number of representatives of insurance organizations and others interested in the matter of safety as related to industrial plants.

The meeting was an enthusiastic one, and all members showed the spirit of coöperation, all being thoroughly convinced of the necessity of standardizing data relating to the reporting of accidents and their classification. One of the principal objects of the meeting was to bring about a coöperative arrangement between the various state organizations and Federal bureaus interested in the collection of statistics relating to the mining industry.

With the view to simplifying the collection of statistics and at the same time relieving the operator of rendering so many reports, it was the consensus of opinion that figures once collected by a state organization should be sufficient for all purposes and that the operator should not be called upon to render another report of a similar nature. It was the purpose of this meeting to standardize and broaden the requests for data so as to include in one report sufficient information for the state mine inspector, the industrial compensation commission and Federal bureaus.

The question of the calendar year was brought up, and all agreed that it should be adopted, and the representatives of the states wherein the fiscal year is at variance with the calendar year pledged themselves to do all they could to bring about legislative enactment to have the latter adopted. One of the principal arguments in favor of the calendar year was that with the enactment of the Federal income-tax law, a report under oath was required of the exact financial conditions of the company on Dec. 31. This law, being Federal, applies to all of the states and is an important argument in favor of the calendar year.

The principal questions discussed at the meeting were the matter of standard forms for recording and publishing matter relating to mine equipment, labor and accidents. The information relating to mine equipment has in its scope a form for a directory of mines in actual operation during a calendar year and data relating to power equipment, ventilating equipment, mining methods and haulage systems.

With reference to accidents, a standard form was discussed that related to fatal and nonfatal accidents, so that sufficient information could be available for anyone interested in the study of accidents. The forms discussed were so grouped and general in their character as to include not only coal and metal mines, but metallurgical plants, quarries and coke ovens.

The result of the meeting was the appointment of a committee to prepare an official report of the proceedings,

which will be published by the Bureau of Mines as a bulletin and will contain copies of all of the standard forms proposed and discussed at this meeting. The coal-mining industry is represented on this committee by James E. Roderick, chairman, chief Department of Mines, Harrisburg, Penn., and James Dalrymple, chief inspector of mines, Denver, Colo. The metal-mining industry is represented by George H. Bolin, state mine inspector, Phœnix, Ariz., and W. B. Orem, state metal-mine inspector, Helena, Mont. The other members of the committee are L. W. Hatch, chief statistician New York Industrial Commission, Albany, N. Y.; John Bohlander, president Illinois State Mining Board, Pekin, Ill., and Albert H. Fay, mining engineer, Bureau of Mines, as secretary of the committee.

There was a formal discussion concerning the standardization of mining laws and regulations as relating to safety in coal mines, the point being made that miners are migratory and in going from one state to another a different set of laws, rules and regulations is encountered with which they are not necessarily familiar. It was unanimously agreed that the Bureau of Mines draft a standard set of rules and regulations for coal mines, similar to that prepared by the bureau relating to metal mines and published as Bulletin No. 75.

Another and allied point very freely discussed was the adoption of certain universal danger signals, so that a miner from one state would meet the same type of signals in a mine in a different state, and it being the same as that used in the mines where he formerly worked, he would at once recognize the meaning. W. L. Chandler, of the National Safety Council, extended an invitation to the state mine inspectors, representatives of industrial commissions and the Bureau of Mines to assist in the establishment of universal danger signals in hazardous industries.

⁂

Tungsten Concentrates Have Been Produced in Missouri, according to the "Iron Trade Review," and the first consignment was forwarded a few days ago to the Crucible Steel Co. of America, Pittsburgh, by F. P. Wherry, Maplewood, Mo. Analysis of these concentrates gave 90% hübnerite, or 70% tungstic acid. It is stated that only 3.3 lb. of mine ore was required to produce each pound of the concentrate.

Petroleum Resources of the United States*

The accompanying table gives the estimated production of petroleum in the United States, together with the approximate figures as to the proven and prospective oil-bearing areas and a summary of the principal points regarding the occurrence and character of the oil.

The figures of future supply take into account a certain percentage of the prospective oil area, as the curve on which they are based pertains to an area where new fields have been added from time to time as development progressed. In the case of Texas, Wyoming, etc., where the ratio of prospective to proven area is high, the future supply may be considerably greater than that predicted if the bulk of the prospective land proves productive.

PAST AND ESTIMATED FUTURE PRODUCTION OF PETROLEUM IN THE UNITED STATES

State	Age of Containing Rocks	Base	Quality of Oil	Production for 1914	Total Prod., Including 1914	Probable Future Supply	Proven Area	Prospective Area	Average Prod. per Acre	Per Cent. Exhaustion
Alaska.....	East-Low. Tertiary West-Jurassic	Paraffin	39°-45.9° Bé. 0.8284–0.7958	.....	.....	10,000,000	....	15	1,000	0
California....	Cretaceous; Tertiary	Asphalt	12°-35° Bé. 0.9859–0.8484	99,775,327	741,273,559	2,300,000,000	156	40	30,000	24
Colorado.....	Pierre-Cretaceous	Paraffin	38°-44° Bé. 0.8333–0.8045	222,773	10,649,143	21,000,000	17	33	1,000	33⅓
Illinois.....	Mississippian-Penna.	Paraffin	28°-39° Bé. 0.8860–0.8284	21,919,749	232,326,616	400,000,000	400	100	2,500	36+
Indiana.....	East-Ordovician (Trenton) West-Pennsylvanian	Paraffin	30°-35° Bé. 0.8750–0.8484	1,335,456	102,823,798	20,000,000	500	100	400	83+
Kansas.....	Pennsylvanian	Par.-Asph.	27°-38° Bé. 0.8917–0.8333	3,103,585	28,547,074	40,000,000	70	30	1,500	42
Kentucky.... Tennessee	Mississippian	Paraffin	25°-43° Bé. 0.9032–0.8092	502,441	9,095,970	10,000,000	100	100	300	47
Louisiana....	Cretaceous-Quaternary Cretaceous-Eocene	Paraffin	21°-41° Bé. 0.9271–0.8187	14,309,435	89,895,433	170,000,000	87	40	4,500	34
Michigan, Missouri	Carboniferous	Paraffin	30° Bé. 0.8750	7,792	72,712	100,000	1	...	.....	58
New Mexico.	Carboniferous-Cretaceous	.....	.....	.....	.....	.....	....	25	.....	....
New York and Penna.	Devonian-Carboniferous	Paraffin	25°-50° Bé. 0.9032–0.7778	9,109,309	754,180,215	135,000,000	1,400	100	1,000	85
Ohio—East and West	Ordovician-Carboniferous	Paraffin	35°-47° Bé. 0.8484–0.7909	8,536,352	432,762,004	205,000,000	115	...	1,500	67
Oklahoma....	Pennsylvanian	Paraffin	32°-41° Bé. 0.8641–0.8187	73,631,724	461,833,466	1,545,000,000	535 297	50 73	10,000	22
Texas.....	Pennsylvanian, Cretaceous-Quaternary	Asphalt and Paraffin	15°-38° Bé. 0.9655–0.8333	20,068,184	203,799,381	400,000,000	50	150	17,000	33+
Utah.....	.....	.....	22°-40° Bé. 0.9210–0.8235	.....	.....	.....	....	20	.....	....
West Va.....	Devonian-Carboniferous	.....	27°-52° Bé. 0.8917–0.7692	.....	.....	.....	....	...	.....	....
Wyoming....	Carboniferous-Cretaceous	Asphalt-Paraffin	18°-48° Bé. 0.9459–0.7865	9,680,033	260,232,815	207,000,000	350	50	2,000	55+
				3,560,375	7,964,944	300,000,000	31	20	15,000	2
				265,762,535	3,345,457,130	5,763,100,000	4,109	946	.....	36

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Shipping Explosives into Mexico

In order to avoid confusion and delay in submitting to the Department of State at Washington, applications for permission to ship munitions of war into Sonora, Chihuahua and Lower California, the following mode of procedure is stated for the benefit of those who contemplate making such shipments:

No munitions of war, such as powder, dynamite, blasting caps, mining fuse, guns and ammunition, etc., will be permitted to enter any of the sections mentioned, without specific authorization of the President. Those desiring to take or ship munitions into any of the territory specified must make application directly to the Department of State, except that persons making shipments of munitions for the *de facto* government of Mexico should submit their applications to the Washington representative of General Carranza. Full details as to amount, destination and purpose for which intended should be given with all applications.

*Excerpt from paper, by Ralph Arnold, entitled "The Petroleum Resources of the United States" in "Economic Geology," December, 1915.

Flotation at Anaconda*

SYNOPSIS—A thorough system of tests was made on the Anaconda ores with a view to determining the applicability of flotation. All methods and machines were tried, and a description of the results is given.

Early in 1914 it was decided to test on a fairly large scale the treatment by flotation of Anaconda slimes and mill tailings. For this purpose a standard-type Minerals Separation machine was installed at the Washoe Reduction Works during May and June, 1914. This was followed by the installation of a full-size Callow pneumatic machine. Experiments were made on a smaller scale with the Froment, the Towne, the Fields and the Anaconda flotation machines. The last was developed at this plant. In addition to the tests made in the standard-type Minerals Separation machine, some were made using a Minerals Separation machine of the sub-aëration type.

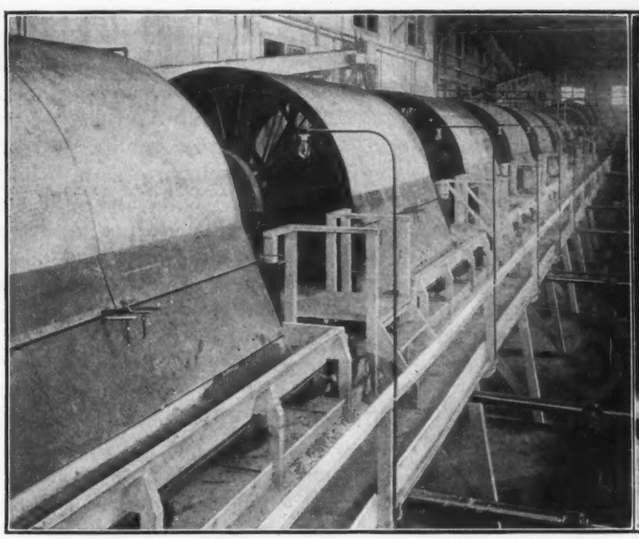
During the experiments a large variety of oils were tested. Experiments using both round-table feed and tailings were also conducted to determine whether it would be better to displace the round tables by flotation for the treatment of the slimes or to supplement the round tables by flotation of the round-table tailings. Tests were also made on treatment of mill tailings by grinding followed by flotation, to determine the relative merits of flotation and leaching for the treatment of this product. Tests were made on mixtures of tailings and slimes.

The round-table feed referred to is the total slimes from the mill. It contains about 35% colloidal solids, and approximately 90 to 95% of the total solids will pass through 200 mesh (0.067 mm.). It assays from 2.3 to 2.6% Cu. The mill tailings referred to are the total discard from the mill, exclusive of the slimes. It is all finer than 2 mm., and about 90 to 95% will remain on 0.25 mm. It assays about 0.60% Cu.

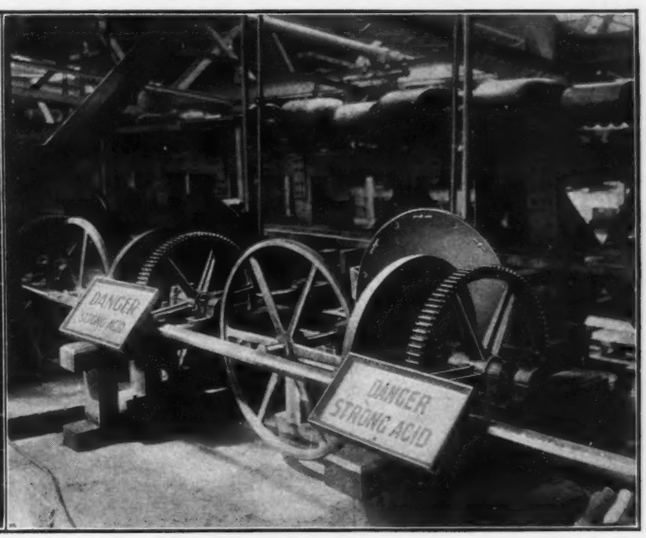
*Abstract of a paper by Frederick Laist and A. E. Wiggin, Anaconda, Mont., to be read at the Arizona meeting of the American Institute of Mining Engineers, September, 1916.

A series of tests was first carried out to determine roughly the best conditions for flotation, using the standard Minerals Separation machine and treating round-table feed. The following reagents were tested, either alone or in combinations: Turpentine, crude oil, cresylic acid, stove oil, tar oil, Carolina oil of tar, argols, sludge acid, fuel oil, wood creosote and sulphuric acid. In some of these tests sulphuric acid was used, and in others it was omitted. Also, the effect of the temperature of the pump upon the flotation results was tested by heating to various temperatures.

As these tests were merely preliminary, no record was kept of the amount of reagents used. It was conclusively proved, however, that the best combination of reagents was sludge acid, wood creosote, stove oil and sulphuric acid. Fortunately, of all the reagents tested these happened to be the cheapest. It was also proved that the addition of sulphuric acid to the pulp was of decided advantage in the treatment of slimes. In two successive tests in which sludge acid, wood creosote and stove oil were used, the tailings assayed 1.25% Cu when no acid was used and 0.3% Cu when acid was used.



OLIVER FILTERS DEWATERING FLOTATION CONCENTRATES



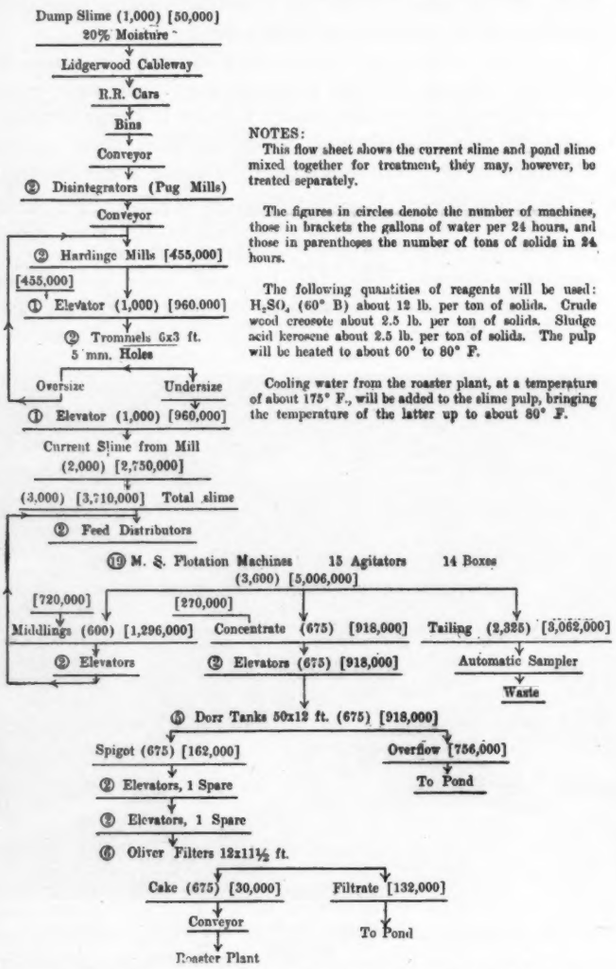
AUTOMATIC REAGENT FEEDERS IN FLOTATION PLANT

Since these tests were made, we have omitted the use of stove oil.

The machine had 16 agitator compartments, each 2 ft. square, and 14 spitzkastens, and was of the standard Minerals Separation design. It is known by us as M. S. machine No. 1. The agitators were of the standard Minerals Separation type, the impellers being 18 in. in diameter and the agitators making 265 r.p.m. This gave the impellers a peripheral speed of 1,245 ft. per min. The machine required 45 to 55 hp., including motor- and belt-transmission loss, when operating under a full load of slimes pulp.

The first products to be tested were the round-table feed and tailings. A thorough series of tests was carried out, and the conclusion was reached that the economic capacity of the M. S. No. 1 machine when treating slimes as produced from the mill at present (May 1, 1915)

seems to be from 80 to 90 tons. The best combination of reagents for the treatment of slimes seems to be sulphuric acid, kerosene sludge acid, wood creosote and stove oil. There is some question as to the real value of the stove oil. Its principal function seems to be to make a more compact froth. It would not be economical to retain the round tables, as the recovery by treating the slimes directly by flotation is just as high as by retaining the round tables and treating the round-table tailings by flotation. The grade of concentrates would probably be the same in either case, but any difference would be in favor of treating the round-table feed directly by flotation. The heating of the round-table tailings pulp, on account of its low density, would increase the cost of the flotation.


Dump Slime (1,000) [50,000]
20% Moisture
Lidgerwood Cableway
R.R. Cars
Bins
Conveyor
② Disintegrators (Pug Mills)
Conveyor
② Hardinge Mills [455,000]
[455,000]
① Elevator (1,000) [960,000]
② Trommels 6x3 ft.
5 mm. Holes
Oversize
Undersize
① Elevator (1,000) [960,000]
Current Slime from Mill
(2,000) [2,750,000]
(3,000) [3,710,000] Total slime
② Feed Distributors
⑩ M. S. Flotation Machines 15 Agitators 14 Boxes
(3,600) [5,006,000]
[720,000]
[270,000]
Middlings (600) [1,296,000]
Concentrate (675) [918,000]
Tailing (2,325) [3,068,000]
② Elevators
② Elevators (675) [918,000]
Automatic Sampler
Waste
⑤ Dorr Tanks 50x12 ft. (675) [918,000]
Spigot (675) [162,000]
Overflow [756,000]
② Elevators, 1 Spare
To Pond
② Elevators, 1 Spare
⑥ Oliver Filters 12x11½ ft.
Cake (675) [30,000]
Filtrate [132,000]
Conveyor
To Pond
Roaster Plant
NOTES:
This flow sheet shows the current slime and pond slime mixed together for treatment, they may, however, be treated separately.
The figures in circles denote the number of machines, those in brackets the gallons of water per 24 hours, and those in parentheses the number of tons of solids in 24 hours.
The following quantities of reagents will be used: H_2SO_4 (60° B) about 12 lb. per ton of solids. Crude wood creosote about 2.5 lb. per ton of solids. Sludge acid kerosene about 2.5 lb. per ton of solids. The pulp will be heated to about 60° to 80° F.
Cooling water from the roaster plant, at a temperature of about 175° F., will be added to the slime pulp, bringing the temperature of the latter up to about 80° F.

FLOW SHEET OF SLIMES-FLOTATION PLANT AT ANACONDA

In treating the round-table feed directly by flotation, the resulting tailings should assay 0.30% Cu or less, with concentrates carrying not over 40% insoluble. Possibly the concentrates can be made much cleaner with no sacrifice in the recovery. It is thought that the best circuit density for the slimes pulp for flotation treatment is about 12% solids. It is believed that about 70° F. will be found to be the most economical temperature at which to keep the pulp. Acid seems to be absolutely essential to the successful treatment by flotation of our slimes. The addition of air in the last spitzkasten is of no advantage. Any considerable increase in speed of the agitators above a peripheral speed of about 1,300 ft. per min. seems to be disadvantageous.

These tests were made in the M. S. No. 1 machine. Mill tailings from sections 7 and 8 of the concentrator were elevated and then dewatered. The dewatered tailings were then crushed through 60 mesh (0.25 mm.), either in a Hardinge mill 10x4 ft., or a tube mill 8x12 ft. The grinding mills were operated in closed circuit with a Dorr classifier, the overflow of the classifier being the final product of the system and going to the flotation plant for treatment. Table 1 gives a screen-sizing test of the average final product produced during the test on the Hardinge mill and is typical of the flotation feed:

TABLE 1. SCREEN-SIZING TEST ON DORR-CLASSIFIER OVERFLOW OR FEED TO FLOTATION MACHINE

Screen Size		Cumulative
Square Mesh	Aperture, Sq.Mm.	%, Solids
+16	1.180	0.3
+24	0.730	1.3
+40	0.430	3.0
+60	0.260	5.8
+80	0.210	12.8
+110	0.130	38.5
+130	0.110	42.3
+160	0.085	54.8
+200	0.076	59.3
+240	0.063	62.8
—240	0.063	37.2

The conclusions from these tests were as follows: Although not definitely demonstrated, it is thought that the economical capacity of the M. S. No. 1 machine when treating sand tailings crushed through 60 mesh is about 175 to 200 tons per 24 hr. The best combination of reagents seems to be sludge acid kerosene and sulphuric acid. However, a mixture of creosote, turpentine and pine oil in a non-acid circuit gave good results also. The non-acid circuit, however, seems to require more delicate adjustment and more careful attendance than the acid circuit. The grinding mill makes an ideal agitator, and it is of decided advantage to add the oil ahead of the grinders. The treatment of the mill sand tailings ground through 60 mesh should result in tailings assaying not over 0.10% Cu and concentrates carrying not over 30% insoluble. It is thought that the best density of pulp is from 25 to 30% solids. Heating of the pulp to about 70° F. seems to be of advantage, although there is a possibility that this heating may be dispensed with during the summer months without any injurious results. Acid seems to be beneficial, but it is not of as much importance as in the treatment of slimes.

Treatment of 60-Mesh Mixed Product

This product was a mixture of round-table feed and mill tailings, and the tests were made in the M. S. No. 1 machine. The acid sludge kerosene, turpentine and the sulphuric acid used were added in the flotation machine. In some instances, various mixtures of coal tar (70 to 80%), creosote (17.5 to 22.5%) and pine oil (2.5 to 7.5%) were used with the sludge acid. These were added ahead of the grinding mill.

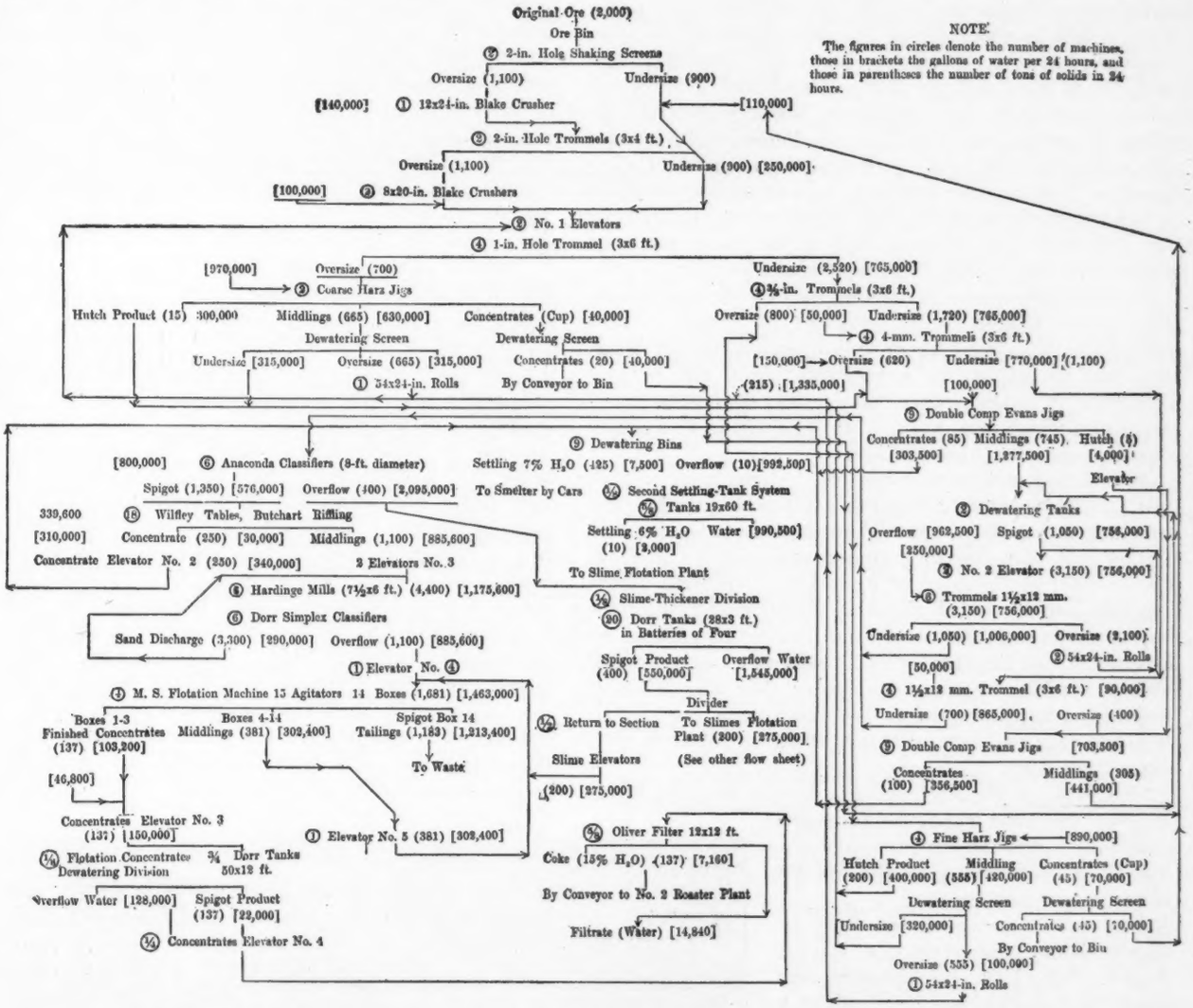
The average proportion of sand tailings to slimes in the mixture treated was 75.7 to 20.1, or 3.8 to 1. In pratice the proportion of production of tailings to slimes is about 3 to 1; thus our mixture was somewhat deficient in slimes. The concentrates produced, 34.1% insoluble, are of good grade, but the tailings are high, 0.20% Cu. Theoretically, the tailings should have assayed about 0.15% Cu, assuming 0.10% Cu tailings from the sand tailings and 0.30% Cu tailings from the slimes. Although this test was not conclusive, it was decided from

observation that it is better to treat the slimes and the sand tailings separately. Of course the slimes made in grinding sand tailings are included in the sand tailings for treatment. These slimes produced in grinding the tailings are of much lower grade and more siliceous than the original mills slimes.

Tests were made with a Minerals Separation machine of the sub-aëration type in the treatment of round-table feed and tailings. The principal difference between this and the No. 1 machine is that air is introduced at the bottom of the agitator compartment. The agitator was of the Howard type, practically a "balanced" pump impeller run backward, and each shaft had two impellers—

Two tests were made—one treating round-table feed, and one treating round-table tailings. The results of these tests are shown in Periods 30 and 31 in the tables. A later test was made in which the spitzkastens were dispensed with and the froth was taken directly off the top of the agitator cells. Under these conditions the four agitators seemed to create too much disturbance for the proper removal of the froth, and only the first and third agitators were operated. These modifications did not improve the work of the machine. This modified machine was called No. 2-A.

Tests made by Mr. Callow at his laboratory in Salt Lake on samples of our mill tailings ground through



FLOW SHEET OF FINES-GRINDING AND FLOTATION SECTIONS IN ANACONDA CONCENTRATOR

one placed above the other and separated by a stationary grid. There was also another grid above the top impeller. There were four agitator compartments and four spitzkasten. The agitators made 185 r.p.m. The feed was introduced through the bottom of the first agitator cell. The launders were arranged so that as many spitzkastens as desired could be sent to finished concentrates, the remainder going to middlings and being returned to the machine. This machine required 47 hp. under a full load of slimes, including motor- and belt-transmission loss.

40, 60 and 80 mesh and of our slimes had given promising results. Accordingly there were shipped here during September, 1914, five standard Callow cells, 2x8 ft., a Pachuca agitating tank and accessory apparatus consisting of blower and sand pumps. In addition to the Pachuca agitator recommended by Mr. Callow, we built a set of two mechanical agitators. These consisted of a tank about 10 ft. long by 2½ ft. wide and 2½ ft. deep, in which revolved a horizontal shaft carrying a set of paddles. These agitators were belt driven from one motor and required a total of 25 to 30 hp., including

motor, belt and countershaft power loss. The agitators seemed to work well and had a combined capacity of about 60 tons of slimes per 24 hr. Power readings made on the blower that furnished the air for the five Callow cells gave the following results:

TABLE 2. POWER REQUIRED FOR AIR SUPPLY

Air Pressure, Lb.	Input to Motor, Hp.	Shafting, Hp.	Net to Blower,* Hp.
4	25.8	8.8	17.0
5	35.4	8.8	26.6
6	47.4	8.8	38.

* Includes motor loss.

Round-table feed and tailings were used in testing the Callow machines, the conclusions derived from them being as follows: On our slimes, air agitation is not as satisfactory as mechanical; the capacity of one standard Callow cell is about 15 to 20 tons of slimes per day; the Callow machine produces clean concentrates but does not give as clean tailings as the Minerals Separation machine; the Callow machine is more sensitive and requires closer attention than the Minerals Separation machine; the cost of repairs would probably be less on the Callow machine than on the Minerals Separation machine, but is comparatively small for either; the power required per ton treated in the Callow system is just about the same as that required by the Minerals Separation plan.

In all of these tests the original feed was divided among the Callow rougher cells, operating in parallel. As a rule there was one cleaner cell operating also. When this was operating, the concentrates from the rougher cells went to it, the cleaner making final concentrates and middlings which were returned to the system. The rougher cells made the final tailings.

A series of tests were made on the treatment of mill tailings after grinding through a 60-mesh screen. The conclusions reached were: The capacity of the standard Callow cell when treating ground mill tailings is about 75 tons per day; no other agitation is required if the reagents can be added ahead of the grinding mill; the use of acid seems to be of considerable advantage; on account of utilizing the grinding mill as an agitator, the Callow machine requires less power than the Minerals Separation machine; the Callow machine is more sensitive and requires more attention than the Minerals Separation machine.

The work of the Froment and Towne and the Fields flotation machines was found to be unsatisfactory; that on the Anaconda cell was of short duration, no definite results being obtained.

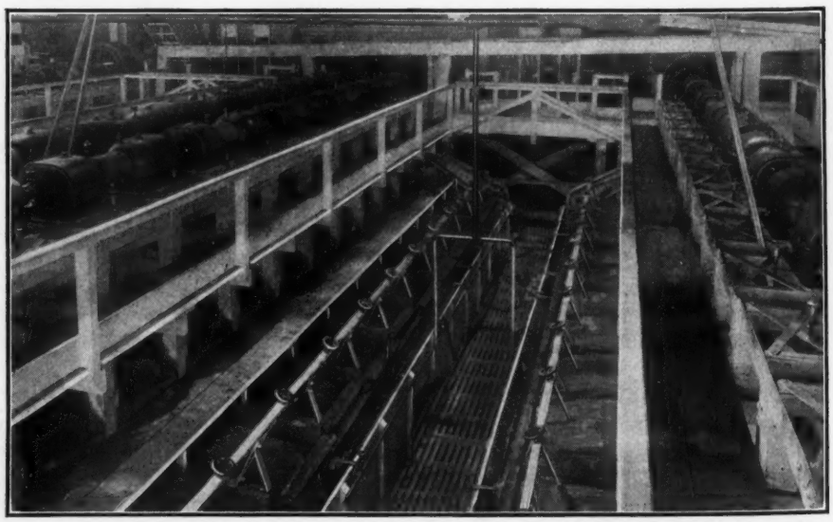
In order to break up the froth in the flotation concentrates a saucer-shaped disk 3 ft. in diameter was constructed. This was revolved at a speed of 300 r.p.m. inside a circular tank. The concentrates pulp was fed upon the disk at the center and was thrown out against the sides of the tank. The impact broke up the froth to a great extent. No test was made on the disintegrator. It was noticed early in the experimental work that an elevator made a good froth breaker, the impact of the pulp discharge at the head of the elevator serving to break up the bubbles to a large extent. A test made at the experimental Callow flotation showed that the rough concentrates pulp was reduced 75% in bulk in passing through an elevator.

The conclusions drawn from the foregoing tests were that the Minerals Separation machine was best adapted for the flotation work at Anaconda and furthermore that the most efficient reagents would be sludge acid kerosene, wood creosote and sulphuric acid.

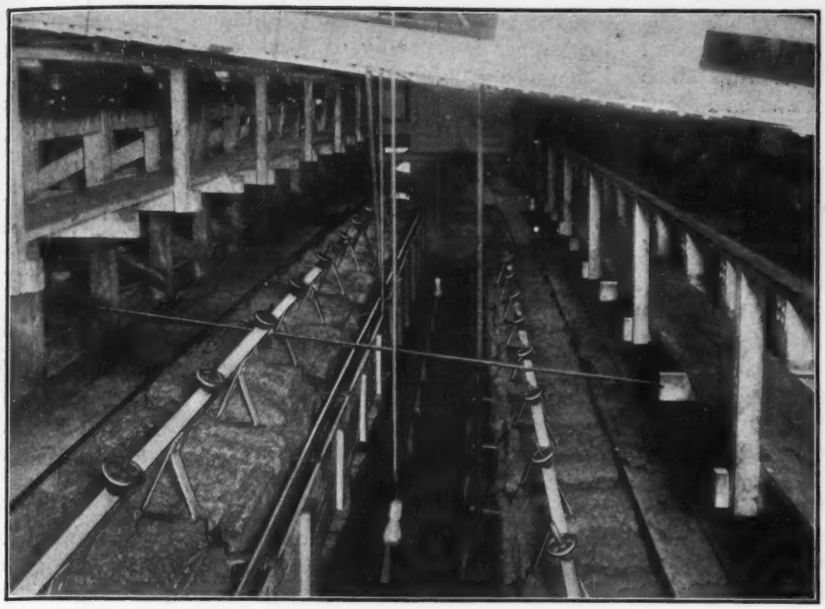
The Concentrator Adapted to Flotation

The concentrator at Anaconda, as remodeled for flotation, consists of 8 sections, each of 2,000 tons' per day capacity. All sections are alike with the exception of section 1, in which Hancock jigs are used in place of Evans jigs and tube-mills are used in place of Hardinge mills. The accompanying drawing shows the flowsheet of section 2 through 8.

The ore is fed from the bins to a 2-in. round-hole shaking screen, the oversize going to a 12x24-in. Blake crusher. The product from this crusher is delivered to 2-in. round-hole trommel, the oversize of which is ent to two 8x20-in. Blake crushers. The product from hese crushers, together with the undersize from the 2- n. screens, is elevated and passed through 1-in. round- hole trommels. The oversize from this is treated in coarse Harz jigs, making middlings and concentrates; the undersize is passed through ⅜-in. trommels, the oversize being treated in fine Harz jigs making concentrates and middlings. All sections are alike up to this point. In section 1, the undersize from the ⅜-in. trommel is screened on 1½x12-mm. trommels, the undersize going to the Anaconda classifiers and the oversize to the Hancock jigs. The treatment of the products from this point is the same in all sections, except that section 1 uses tube-mills in place of Hardinge mills for grinding, as noted previously. The undersize from the ⅜-in. trommel is screened through 4-mm. trommels, the oversize from these going to the double-compound Evans jigs and the undersize going to 1½x12-mm. trommels. The undersize from these trommels goes to the Anaconda classifiers, the oversize to double-compound Evans jigs. The two sets of Evans jigs make concentrates that go to the dewatering bins and middlings that are ground for further treatment by another process.



MINERALS SEPARATION MACHINES TREATING SLIMES



MINERALS SEPARATION MACHINES TREATING SAND TAILINGS

The concentrates from the coarse Harz jigs are dewatered and conveyed to bins. The middlings are screened on a dewatering screen, the undersize, together with the hutch product from the coarse Harz jigs, going to the Evans jigs. The oversize is passed through rolls 54x24 in. and thence back into the system ahead of the 1-in. round-hole trommels. The concentrates from the fine Harz jigs are sent to the bins. The middlings are screened through a dewatering screen, the oversize going to 54x24-in. rolls and then back into the system ahead of the 1-in. round-hole trommels. The undersize of the dewatering screen, together with the hutch discharge of the fine Harz jigs, goes to the Evans jigs. The concentrates from the Evans jigs are dewatered in bins to about 7% moisture and sent to the smeltery. The jig concentrates assay about 15% insoluble and 8% copper. The middlings, together with the hutch product, are dewatered in tanks and screened through 1½x12-mm. trommels, the undersize from which goes to the Anaconda classifiers, the oversize through 54x24-in. rolls and back to the 1½x12-mm. trommels.

The spigot from the Anaconda classifier is treated on 18 Wilfley tables fitted with Butchart riffling, making concentrates and middlings. These tables make concentrates assaying 25% insoluble and middlings assaying 0.9% Cu. The concentrates are sent to the dewatering bins, together with the fine jig concentrates, and the middlings are sent to the 10x4-ft. Hardinge mills. The overflow from the Anaconda classifiers is sent to the slimes-thickener division, consisting of 28x3-ft. Dorr tanks. The spigot product from these tanks is divided; about one-half is returned to the section and the rest is sent to the slimes plant.

The product from the Hardinge mills (Fig. 2) is treated in six simplex Dorr classifiers—one classifier to each mill—the overflow going to the flotation division and the classifier sand being returned to the mill.

The flotation division consists of four Minerals Separation machines, each having 15 agitators 3 ft. square, and 14 spitzkastens, or floating compartments. The agitators for the Minerals Separation machines are of gun metal and are driven by bevel gears from a lineshaft, the direction of rotation of the agitators alternating. The machines are made of California redwood; the agitator boxes are further lined with hard maple extending about 18 in. from the bottom of the box. Each machine has an individual drive, power being supplied to the lineshaft by a 150-hp. motor running at 385 r.p.m. The speed of the agitators is 225 r.p.m. and as the impellers are 18 in. in diameter the peripheral speed is about 1,060 ft. per min. Each machine makes three products: Concentrates, which go to the dewatering division; middlings, which are returned to the head of the machine; and tailings, which go to waste. The concentrates are taken from the first 3 to 5 spitzkastens and the middlings from the last 9 to 11. A portion of the pulp is overflowed from the last three spitzkastens together with the froth. About 6 to 8 lb. of (50° Bé.) H_2SO_4 per ton of flotation feed is used together with 2 to 3 lb. of kerosene sludge acid and ½ to 1 lb. of crude wood creosote. A portion of the wood creosote is added ahead of the Hardinge mill (about 0.03 to 0.05 lb. per ton of feed), and the remainder is added in the sixth agitating compartment. The sulphuric acid and sludge acid are added at the head of the machine. The pulp is heated to from 60° to 70° F. by passing live steam into it at the head of the machine. Three machines are used for treating sand and the fourth for treating current slimes from the upper portion of the mill. Each machine has a capacity of about 400 tons per day on sand and 175 tons on slimes.

The method of adding the oil and acid is rather unique. The mechanism consists of a revolving disk to which are attached, around the circumference, a number of cups. This disk is set vertically so that its lower edge dips into a pan of acid or oil. As the cups come around, they are filled and later discharge their contents into a suitable launder leading to the flotation machine. The disk is driven by the friction of a wheel against another disk attached to the main drive. The wheel is run at constant speed, and by varying the point of contact between wheel and disk any speed desired can be given to the main disk and thus the amount of oil or acid added can be regulated. In addition to the speed regulation the amount of oil or acid fed may be varied by adding or removing cups or by changing their size.

Table 3 gives metallurgical data concerning the operation of the mill. Line 1 gives the monthly assay of second-class ore for October, which is the feed to the mill.

TABLE 3. MILL-OPERATING DATA

	% Cu	% SiO_2	% Al_2O_3	% Fe	% S	% CaO	Oz. per Ton, Ag	Oz. per Ton, Au
Feed to concentrator....	2.85	59.1	9.4	10.6	11.8	0.6	2.00	0.0070
Total concentrator tailings (flotation).....	0.13	81.6	11.3	1.0	0.5	0.5	0.10	0.0005

Line 2 gives the monthly assay of the flotation tailings from the remodeled sections for October. The feed to the flotation machines during the month consisted of reground sand tailings and a portion of the thickened mill slimes, which was returned to the mill and treated

in the fourth machine in each remodeled section. The tailings assay shown, 0.13% Cu, is for the total sand and slimes tailings produced. The sand tailings alone averaged 0.10% Cu and the slimes tailings averaged about 0.25% Cu.

No complete analyses of the flotation concentrates are available, as the slimes-flotation plant is not in operation yet and the round-table concentrates are being mixed with the flotation concentrates from the mill.

Description of Slimes-Flotation Plant

Because of lack of space in the mill an auxiliary plant had to be installed to handle the extra slimes. This plant consists of 20 Minerals Separation machines of the same type and size as those used in the concentrator and five 50x12-ft. Dorr tanks for dewatering the concentrates. The plant is designed to treat about 2,000 tons of current slimes and 1,000 tons of pond slimes, and was to be operating by Dec. 15, 1915. What it may be expected to do so far as the treatment of current slimes is concerned may be judged from the results obtained in the experimental slimes machine, which has been operating regularly for more than a year.

Table 4 gives the analysis of the current slimes and the assay of the composite tailings sample for the month of June. These are typical of the results which may be expected in the large plant.

TABLE 4. OPERATION OF EXPERIMENTAL SLIMES-FLOTATION PLANT

%	Feed (Current Slimes)	Tailings	Concentrates
Cu	2.10	0.27	12.0
SiO_2	61.00	67.70	20.0
FeO	4.10	2.70	28.0
S	4.40	1.10	....
Al_2O_3	19.00	18.30	....
CaO	0.60	0.70	....
Ag, oz. per ton	1.80	0.20	....
Au, oz. per ton	0.005	0.001	....

The treatment of pond slimes offers a few more difficulties than that of the current slimes. They have been exposed to the weather for a number of years so that the copper is partially oxidized, consequently that portion probably cannot be floated. Some results from the flotation plant at Great Falls, covering a week's operation, are tabulated below. This character of material has been treated for some time at the Great Falls plant, and the results should be a good criterion of what may be expected here in the treatment of dump slimes.

TABLE 5. OPERATION OF SLIMES-FLOTATION PLANT AT GREAT FALLS

	%
Recovery based on concentrates	78.90
Recovery based on tailings	80.90
Average total Cu in tailings	0.53
Average soluble Cu in tailings	0.13
Average sulphide Cu in tailings	0.40
Average total Cu in feed	2.52

At Great Falls one double Minerals Separation machine of the same design and size as used at Anaconda is treating from 300 to 350 tons of dump slimes daily.

Experiments covering a period of five days, in which five tons of sodium sulphide were consumed, were made at the Great Falls plant to determine the feasibility of sulphidizing the oxidized copper prior to flotation. Sodium sulphide in solution was added at the pug mill, together with the dump slimes. No difficulty was found in sulphidizing practically all of the copper that went into solution, but it was found that all oxidized copper was not dissolved during its passage through the pug mill and flotation machine. Moreover, on the addition of sodium sulphide the froth immediately broke up—a large part of the natural sulphides no longer floating and the tailings assay showing a marked increase, although the precipitated sulphides floated. Hardly any froth was formed, probably because of the colloidal state of the precipitated sulphides rather than the result of any deleterious action on the oils used of the sodium sulphide or the sodium sulphate formed during the operation.

TABLE 6. SUMMARY OF FLOTATION TESTS—MINERALS SEPARATION MACHINE NO. 1

Treatment of Slimes: Round-Table Feed and Tailings

	Feed				Concentrates Assay				Tailings Assay,	% Cu Recovered	Temperature, °F.			Reagents Used, Lb. per Ton					P. T. & T. Co., 400
Period	Tons per 24 Hr.	Assay, % Cu	Density, % Solids	Hours in Operation	% Cu	% Insol.	% FeO	Ag Oz. per Ton	% Cu		Feed Pulp	Pulp in Machine	Difference	Sludge Acid	Wood Creosote	Stove Oil	H_2SO_4	Turpentine	Tar Creosote	
1	Preliminary																			
2	61.0	2.04	13.7	120.0	8.2	54.7	13.7	...	0.31	89.3	54	89	35	3.8	2.4	0.36	12.6	...	...	.....
3	64.2	2.07	14.9	72.0	7.2	62.0	10.8	6.0	0.38	86.0	51	51	0	3.6	2.3	0.29	13.3	...	...	.....
4	56.2	2.08	13.6	48.0	8.3	51.1	15.6	6.7	0.27	90.4	53	125	72	3.9	2.8	0.33	12.6	...	...	.....
5	52.2	1.16	11.7	56.0	6.6	66.1	7.8	5.8	0.33	75.5	54	54	0	3.5	3.8	0.37	15.2	...	...	.....
6	48.2	1.08	11.1	72.0	7.2	62.1	8.9	6.8	0.31	74.3	54	106	52	3.9	4.2	0.29	11.8	...	...	.....
7	63.8	2.24	22.5	40.0	9.2	52.9	12.8	7.8	0.28	90.3	53	96	43	2.7	2.4	0.33	12.5	...	...	.....
8	104.8	2.19	24.5	88.0	8.9	57.5	11.2	6.45	0.63	76.6	53	96	43	3.1	2.4	0.32	13.9*	...	...	.....
9	94.7	2.25	22.7	120.0	8.7	60.5	9.2	6.45	1.34	47.5	54	54	0	2.0	2.2	0.21	16.4	...	...	.....
10	60.4	2.20	14.5	96.0	10.1	52.6	12.4	7.9	0.50	82.0	48	48	0	3.3	2.9	0.21	16.5	...	...	.....
11	58.2	2.39	14.5	144.0	9.2	53.3	12.8	6.8	0.33	89.5	50	81	31	3.5	3.4	0.42	12.7	...	...	.....
12	56.1	1.11	18.1	24.0	5.9	71.8	5.2	4.4	0.53	57.8	52	72	20	3.7	3.7	0.28	16.1	...	...	.....
13A	60.6	1.11	13.5	184.0	5.8	71.3	5.6	4.2	0.28	79.1	52	80	28	3.7	3.5	0.30	16.8	...	...	.....
13B	51.6	1.35	11.1	32.0	2.0	85.0	2.5	1.0	1.04	47.8	51	80	29	5.5	3.1	0.27	00.0	...	...	.....
14A	31.7	1.17	5.6	48.0	6.8	66.2	7.4	4.6	0.30	77.8	50	80	30	5.1	4.3	0.32	18.9	...	...	.....
14B	42.6	1.17	6.8	24.0	5.9	68.0	7.2	4.6	0.24	82.7	50	71	21	4.4	...	0.37	21.0	3.7	...	.....
14C	40.4	1.12	6.7	80.0	6.1	67.2	8.3	4.8	0.23	82.5	52	80	28	4.4	4.0	0.28	18.5	...	...	.....
14D	40.0	1.13	6.5	16.0	9.8	54.3	11.5	6.6	0.32	....	52	81	29	5.0	4.2	0.73	20.1	...	...	.....
15A	42.7	2.35	9.4	40.0	9.3	47.2	17.0	6.7	0.23	92.5	48	82	34	4.3	4.5	0.33	20.7	...	...	.....
15B	48.0	2.51	8.0	32.0	13.4	33.6	20.9	8.8	0.26	91.5	48	78	30	5.4	...	0.34	20.0	...	4.7	.....
15C	49.0	2.52	8.8	80.0	10.8	44.2	18.4	8.3	0.25	92.2	45	71	26	3.8	...	0.41	19.3	3.3	...	.....
15D	49.4	2.25	9.7	40.0	11.0	40.7	19.3	8.1	0.38	86.0	46	70	24	9.0	...	0.33	19.3	...	...	.....
15E	50.2	2.52	9.3	40.0	14.3	28.9	23.6	11.4	0.48	83.8	44	70	26	4.0	...	0.49	18.6	...	4.5	.....
16A	49.0	2.55	11.5	248.0	9.7	48.8	16.0	7.7	0.27	92.1	44	68	24	3.2	4.7	0.46	20.9	...	...	.....
16B	55.2	2.58	13.7	24.0	10.6	48.5	15.6	9.2	0.56	83.0	45	66	21	5.9	4.6	0.31	23.2	...	...	.....
17	40.0	1.10	5.8	576.0	7.5	63.0	9.3	5.9	0.22	82.4	43	69	26	4.7	4.8	0.30	16.7	...	...	.....
18	42.0	1.11	5.8	334.9	7.0	65.9	7.7	4.7	0.26	79.5	40	70	30	4.1	4.54	0.19	19.6	...	...	.....
19	90.0	2.57	15.7	236.4	14.8	31.3	22.1	11.2	0.43	85.8	39	72	33	2.54	1.38	0.14	13.1	...	...	1.61
20	60.2	2.74	15.3	211.3	12.0	38.3	20.6	8.8	0.33	90.5	39	70	31	3.27	...	0.26	15.6	...	...	1.73†
21	40.9	2.48	15.1	313.1	10.1	43.7	18.8	6.9	0.25	92.3	40	76	36	6.15	...	0.29	19.5	...	...	3.60
22	88.2	2.54	15.9	417.7	11.9	39.4	20.1	8.4	0.25	92.3	41	74	33	2.99	...	0.13	13.5	...	...	1.88
23	89.9	2.60	15.4	283.7	12.3	36.4	20.8	9.3	0.27	91.6	43	74	31	3.27	...	0 18	14.9	...	...	1.52
30‡	93.3	2.55	10.7	336.0	8.3	55.2	13.3	5.8	0.41	99.3	44	65	21	3.7	3.4	0.71	21.1	...	...	.....
31‡	45.1	1.10	5.7	720.0	4.5	74.3	5.7	.....	0.27	80.3	44	65	21	3.9	3.3	0.34	18.7	...	...	.....
Treatment of Sand Tailings from Mill, Ground Through 0.25 Mm.																				
24	Preliminary																			
25	125.0	0.62	22.3	55.8	6.35	40.1	26.8	4.2	0.07	93.0	40	69	29	2.5	...	....	7.6	...	...	.....
26	186.7	0.87	30.9	472.6	7.82	26.9	32.5	5.4	0.11	88.6	43	69	26	3.1	0.7	....	4.9	...	...	0.3§
27	124.1	0.67	26.1	120.5	5.42	42.2	25.4	4.2	0.12	84.0	42	72	30	...	...	0.3	1.3	3.9	...	.....

This table gives the average of the results of each period. * During this period about 1.8 lb. of fuel oil per ton of feed was used with the other oils. † During two days of this test Midwest Refining Co. sludge acid was used along with the other reagents at the rate of 3.69 lb. per ton and on another day Western Oil Co. sludge acid at the rate of 1.04 lb. per ton. No improvement found in either instance. ‡ These tests were made in M. S. Machine No. 2. § Average of four days' test. Results not improved by this oil. For two days 1/7 lb. of Standard Oil Co. Sludge Acid Kerosene per ton of feed was used along with the P. T. & T. Co.'s No. 400. No marked improvement noted. Wood creosote used for only six days. Tailings assayed about 0.09 during this time.

The cause of the breaking of the froth was not clear. It may have been due to the sodium sulphate formed or, what seems more probable, to some impurities in the sodium sulphide, the latter being only about 50% pure. This effect was general, the froth on the second machine breaking up, although no sodium sulphide was added to it except through a return-middlings elevator that was common to both machines.

Description of Concentrates-Dewatering Plant

The dewatering of the flotation concentrates is done in six 50x12-ft. Dorr thickeners. Five tanks of the same size have been provided for the slimes plant. The pulp is delivered to a baffle box about 5 ft. square in the center of the tank and extending down to within a few inches of the rake arms. Surrounding this is another baffle about 15 ft. square and extending about 18 in. below the surface of the water. These baffles catch a large portion of the froth, which is there broken up by means of a water spray. The capacity of these tanks when treating flotation concentrates is from 200,000 to 250,000 gal. of pulp per 24 hr., although they will probably not be required to handle more than 200,000 gal. Operating even at this capacity, there is a small amount of finely divided material that will not settle. Therefore the overflow from these tanks is run to a slime pond and the solids collected for future treatment. The capacity of these same tanks when treating round-table concentrates is about 1,000,000 gal. of pulp per 24 hr.

Some experiments were made to increase the capacity of the tanks by the use of glue. Indications from tests in a beaker seemed to indicate that glue would greatly aid the settling, but this did not prove to be the case. The glue caused the colloidal material to coagulate, but it did not actually increase the capacity of the settling tanks to any great extent.

The density of the pulp delivered to the tanks averages from 18 to 20% solids; from the spigot averages about 60% solids. The spigot product is further dewatered in Oliver filters 11½ ft. diameter by 12 ft. face. There will be 11 of these, each capable of handling 150 tons per 24 hr. and making a cake containing about 15% moisture. The cake from the filters is delivered to a belt conveyor and is carried with the fine mill concentrates to the new roaster plant[1]. In this way a fairly good mixing of the concentrates will be obtained.

TABLE 7. TREATMENT OF ROUND-TABLE FEED BY FLOTATION PROCESS.—MINERALS SEPARATION MACHINE NO. 2A

Date, 1915	Rate per 24 Hr. Gallons Pulp	Tons Solids	Assay Feed, % Cu	Temperature of Circuit, °F.	Tailings Assay, % Cu	Concentrate, % Cu	Concentrate, % Insoluble	Concentrate, % FeO	Reagents, Lb. per Ton H_2SO_4	Reagents, Lb. per Ton M. S. 37	Reagents, Lb. per Ton P. T. & T. Co. 400	Reagents, Lb. per Ton M. S. 8
Feb. 27.....	58,900	39.5	2.59	90.9	0.86	8.3	54.4	14.3	26.3	6.9	2.3	0.15
Feb. 28.....	40,200	29.8	2.50	87.2	0.73	9.8	36.9	27.1	30.1	7.0	3.2	0.04
March 1....	44,600	29.7	2.50	86.1	0.93	10.0	46.4	18.3	26.1	7.3	5.3	0.50
March 2....	49,300	34.6	2.55	92.6	0.50	5.9	62.2	11.9	20.9	6.5	2.7	0.20
March 3....	52,200	36.4	2.62	90.7	0.47	6.0	60.5	12.6	22.3	6.1	1.3	0.07
March 4....	55,100	39.7	2.54	86.0	0.61	7.0	58.0	13.0	17.6	5.1	2.4	0.03
Average..	50,050	34.9	2.55	88.9	9.68	7.8	53.1	16.2	20.5	6.5	2.9	0.16

The machine was in good running order, mechanically, on Feb. 27, 1915. There seemed to be too much agitation at first, so No. 4 impeller was dropped off shaft. Machine ran this way until Mar. 3, when the No. 2 impeller was dropped. Air was blown in under each impeller. With first and third impellers operating, the input to the motor was 32 hp.

TABLE 8. SUMMARY OF FLOTATION TESTS—CALLOW PNEUMATIC MACHINE

Period	Hours in Operation	Number of Rougher Cells Operating	Air Pressure, Lb. per Sq.In.	Feed % on 80 Mesh	Feed Density, % Solids	Feed Assay, % Cu	Tons per Rougher Cell	Temperature of Pulp in Circulation	Reagents Used, Lb. per Ton H_2SO_4	Sludge Acid	Crude Wood Creosote	Stove Oil	Turpentine	Fuel Oil	Pine Tar	Final Tailings, % Cu	Final Concentrates % Cu	Final Concentrates % Insol.	Final Concentrates % FeO	Middling, % Cu	Rougher Concentrates % Cu	Rougher Concentrates % Insol.	Rougher Concentrates % FeO	% Cu Recovered
32	Preliminary																							
33*	246.5	2.8	4.52	....	14.7	2.57	15.0	72.4	18.4	5.75	3.04†	.51†	....	....	...	0.35	13.7	31.6	23.6	1.71	6.7	54.4	13.8	88.6
34‡	500.1	2.0	4.00	....	15.2	2.57	20.2	71.1	12.4	3.82	3.13	.35	....	0.24	...	0.30	12.0	34.2	23.4	1.69	6.0	56.8	13.3	90.6
35	42.8	3.3	4.00	....	5.6	1.66	11.4	68.8	18.5	9.05	.....	....	....	0.71	...	0.32	12.7	53.9	10.0	....	6.0	64.8	6.5	83.3
Treatment of Mill Tailing																								
36	249.0	2.0	4.00	13.4	27.5	0.64	108.5	64.5	3.3	2.4	.....	....	....	....	...	0.10	6.53	42.2	25.0	0.52	2.9	79.1	7.4	....
37	120.8	2.0	4.00	6.5	27.1	0.77	75.6	72.6	5.3	2.5	.....	....	....	....	...	0.11	7.81	27.9	32.4§	1.25	3.8	....	....	....
38	40.0	1.6	3.90	6.9	22.1	0.65	58.2	69.9	0.0	0.0	.....	....	2.7	....	...	0.16	6.23	35.1	28.8‖	1.18	3.2	....	....	....
39	76.7	...	2.60	....	22.0	0.72	39.9	67.4	....	....	.....	....	3.03	....	...	0.18	5.6	47.5	32.2	....	....	....	....	....

* Air agitation used throughout this period. † These oils were used only during first five days. ‡ Mechanical agitation used throughout Period 34. § Concentrate assayed 4.8 oz. silver per ton. ‖ Concentrate assayed 5.2 oz. silver per ton.

Ontario Mineral Production

The Ontario Bureau of Mines has just issued its preliminary report of mineral production (Bull. No. 28), for 1915, subject to revision. The principal items, arranged in order of descending value were the following: Nickel in matte, 34,039 tons; silver, 23,730,839 oz.; gold, 411,588 oz.; pig iron, 493,400 tons; copper in matte, 19,608 tons; portland cement, 2,302,242 bbl.; natural gas, 12,273,503 M cu.ft.; iron ore, 394,054 tons; salt, 116,648; iron pyrites, 145,315 tons; crude petroleum, 7,505,478 Imp. gal.; cobalt oxide, 314,906 lb.; lime, 1,340,394 bu.; gypsum, crushed, ground and calcined, 81,172 tons; calcium carbide, 2,555 tons; white arsenic, 4,979,141 lb.; quartz, 95,460 tons; graphite, refined, 2.489 tons; metallic cobalt, 11,905 lb.; talc, ground and crude, 11,005 tons; sand and gravel, 257,473 cu.yd.; feldspar, 9,809 tons; mica, 195 tons; corundum, 262 tons; cobalt ore, 177 tons; nickel oxide, 145,323 lb.; molybdenite ore, 193 tons; metallic nickel, 11,905 lb.; copper ore, 271 tons; molybdenite concentrates, 1,068 lb.; metallic arsenic, 1,518 lb.

The total value of the mineral production for 1915 was $57,532,844, as compared with $46,295,959 in the previous year.

There was a large increase in the production of gold—more than 53%—and in nickel and copper, the latter due to the unusual demand for these metals for armament and munition purposes.

In the production of silver there was a decrease of 1,487,155 oz., or 5.9%. In part this decrease is attributable to the low price of silver. In November and December the price rose sharply, resulting in increased production. Of the total production, the Cobalt camp contributed 23,187,545 oz., valued at $11,742,463.

[1]The new roaster plant consists of twenty-eight 25-ft. Wedge furnaces. This will about double the roaster capacity of the plant.

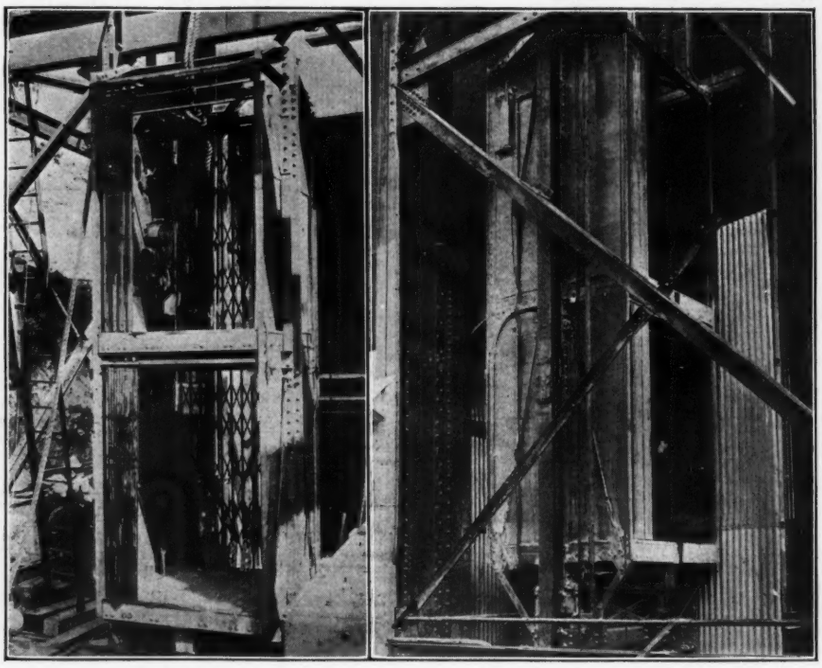
Details of Practical Mining

New Man Hoist at Inspiration

One of the outstanding features of the new shaft recently sunk at Miami, Ariz., by the Inspiration Consolidated Copper Co. is the modern and completely equipped man hoist installed by the Otis Elevator Co. Beyond question this is the finest equipment ever installed at any mine for the purpose of hoisting miners to and from their work. It is, in fact, a modern passenger elevator with all safety devices, such as is installed in many of the country's tall office buildings.

The shaft in which the hoist operates is lined throughout with reinforced concrete, and at the present time has been carried down to the 700 level, although the hoist is arranged for an ultimate cage travel of 1,150 ft.

On account of the great expense involved in the sinking of deep shafts, it was found impracticable to make the cage area of a single deck sufficient to accommodate the number of men it was desired to carry on a trip, and accordingly the cage has been constructed with two decks each about 5 ft. sq., and capable of carrying 20 men. These decks are inclosed on two sides by heavy sheet-iron panels and on the other two sides by collapsible steel gates, which are provided with automatic contacts connected in series with the electrical control, making it necessary that all four of the gates be closed before the operator can start the cage. Likewise, should any gate be opened while the cage is in motion, all power will be immediately cut off from the hoisting machine and the cage will stop in its travel.



THE DOUBLE-DECK MAN CAGE AT INSPIRATION

The cage is operated by means of a master switch on the upper deck, in charge of a regular attendant. By placing the control of the hoist on the cage itself, a great deal of time is saved that would otherwise be consumed in the transmission of signals from the shaft to the engineer in the hoisting room. However, the cage may be operated from the engine room, where there is a duplicate of the master switch on the cage. The usual mechanical indicator, operated through gearing mounted on the drum shaft of the hoisting machine, keeps the engineer advised of the position of the cage in the shaft, while telephonic communication keeps the cage operator in constant touch with the engine room.

The cage runs on planed, steel guide rails and is provided with a wedge-clamp safety device actuated by a centrifugal governor placed at the top of the frame. The capacity of the hoist is 7,500 lb. at a normal operating speed of 800 ft. per min. By means of switches the governor will automatically reduce the speed of the motor when the cage speed exceeds 850 ft. per min. Should the cage continue to accelerate after these switches have operated, all current would be cut off from the motor at a cage speed of 960 ft. per min. In case the cage should not stop through this action of the safety governor, at a cage speed of 1,120 ft. per min. the governor would mechanically trip the safety wedge clamp beneath the cage, causing the clamps of the safety to grip the guide rails with increasing pressure until the cage was brought to a positive stop. This is the form of safety device commonly used with high-speed passenger elevators.

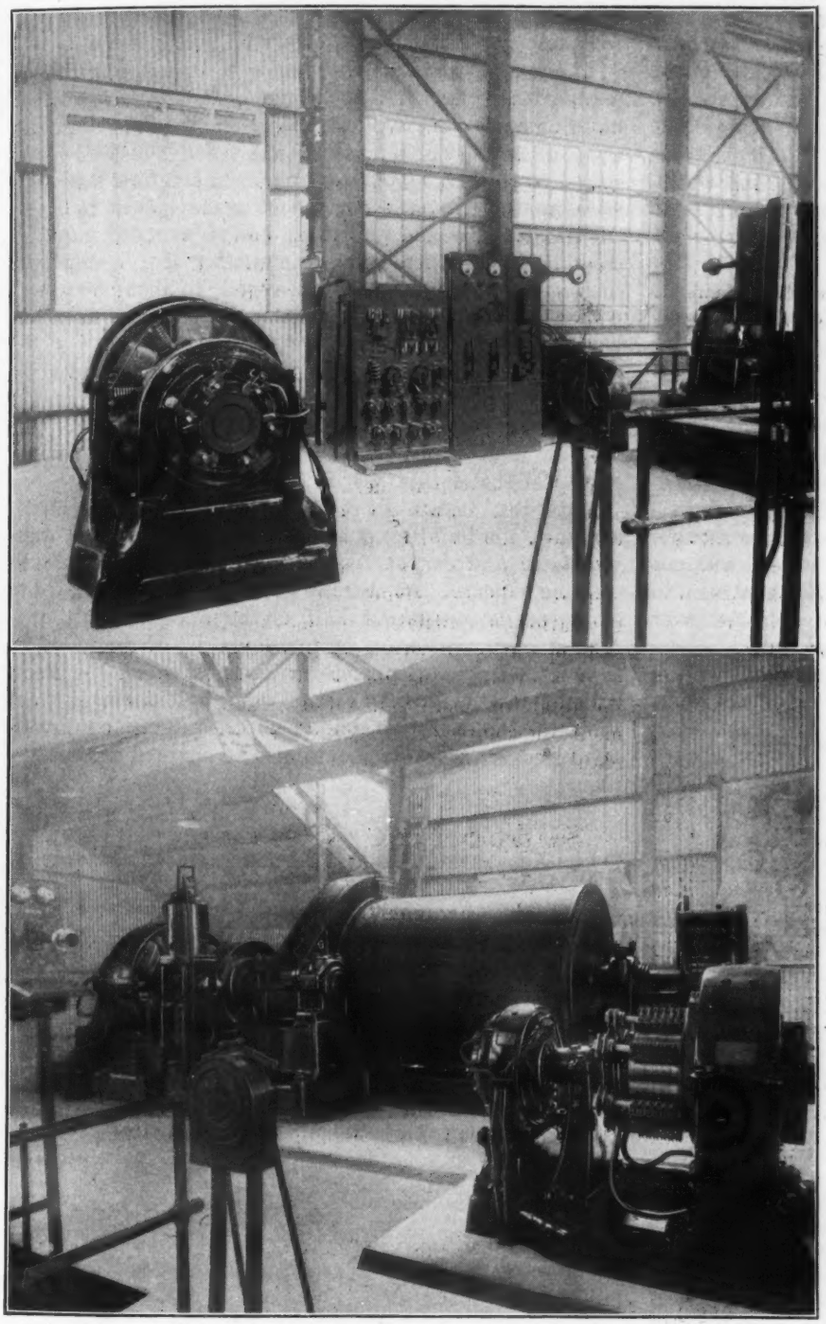
Another safety device consists of two long-stroke hydraulic buffers, situated at the bottom of the shaft. These are designed to bring the cage to a gradual stop from full speed, without injury or shock to passengers, through the displacement of fluid in the buffers at a carefully calculated rate of retardation, which is regulated by the escape of the fluid from one chamber of the buffer to another.

The cage is suspended in the shaft by a single 1⅛-in. plow-steel cable running over a large sheave at the top of the shaft and thence over a similar sheave at the easterly shaft to the winding drum of the hoisting machine in the engine room. The cage is counterbalanced by a counterweight, which travels in a special shaft alongside of the east ore-hoist shafts.

The hoist is automatically slowed down and stopped at the top and bottom of the shaft by a stop-motion device, which is operated by an extension of the drum shaft of the hoisting machine. Additional safeguards are provided in the form of limit switches placed beyond the range of the stop-motion device and designed to auto-

matically stop the hoist in case either the car or the counterbalance passes the normal limits of travel. These limit switches are placed in the superstructure.

The machine is of the single-reduction herringbone-gear type, with a winding drum 72 in. in diameter, driven by a 160-hp. 6-pole motor operating at a speed of 385 r.p.m. The motor is provided with interpoles. A powerful band brake, applied by a weight and a heavy spiral spring and released by an electromagnet, serves to hold the cage immovable when current is off. A Francke flexible coupling is used to connect the motor shaft to the pinion shaft. The Ward-Leonard system of control is used.



OTIS HOISTING MACHINE, MASTER SWITCH AND ACCESSORY EQUIPMENT FOR INSPIRATION MAN HOIST

The power for operating the hoist is generated at the Roosevelt dam and is received at the transformer substation at a voltage of 44,000, which is stepped down to 2,200. A three-phase General Electric induction motor directly connected to a G. E. continuous-current generator furnishes the power for the elevator. A small continuous-current generator mounted on the end of the motor-generator set furnishes the direct current used for the controller magnets, brake and fields of the hoist motor and generator.

Wash House for Miners*

Some of the main factors to be considered in designing a miner's wash house are as follows: Facilities and arrangements for accommodating a large number of men in a short space of time; large quantities of warm water to be furnished in a short time, with temperature regulated so that the men cannot be scalded, but with an arrangement for economy in the amount of water used; equipment for safe-keeping of clothes, drying and ventilating them and at the same time rendering them readily accessible to the owner only; fireproof construction, drainage, heating and light; rugged equipment that will stand abuse, and sufficient area to prevent crowding and congestion.

The wash house described in this article conforms to all these fundamentals at a cost of $15.86 per man, which under the conditions seems to be about as low as can be expected, although it could be reduced somewhat by using warm water only, instead of hot and cold, by using boiler-feed pumps instead of a tank, by the elimination of the bosses' bath and the first-aid room and possibly a few other items which, like the foregoing, are highly desirable but not absolutely necessary. The bosses' bath, first-aid room and cold-water facilities at this wash house cost close to $1,000, so that cutting them out would reduce the cost per man to about $13.36 for a fireproof house equipped to take care of 400 men. The water for the showers and basins in this building is heated by either exhaust or live steam or, if conditions demand, by both.

The valves on the showers and bibs at basins are of the self-closing type, so that little water is wasted. The valve on the shower is controlled by a short chain that hangs down just in reach of the bather. He is supposed to hold onto the chain with his left hand while he uses the soap with the other, but when he releases the chain to rub his body or has finished his shower, the valve snaps shut. This arrangement makes a material

*Excerpt from article by John A. Garcia, consulting engineer, Chicago, Ill., in "Coal Age," Jan. 16, 1916.

reduction in the amount of water used, since most of the wasted water in the wash houses comes from continuous feed showers, the water flowing from them a large part of the time when the bather has no need of it or when no one is under the spray.

The clothes hangers are arranged for an average spacing of 22 in., which is found to be entirely sufficient to prevent contact and still not wasteful of building space. The hangers are made of malleable iron, have three prongs, or hooks, to which the clothes are attached and a small wire basket for soap, lamp, etc. The whole outfit is attached to a stout chain and raised or lowered by means of a pulley attached to the ceiling. When clothes are hoisted, there is a clearance of from 8 to 9 ft. from them to the floor, and the monitor sash at the top of the building allows the warm air to flow up through the suspended clothing, thus drying it out and carrying off all offensive odors.

Once a week the monitor sash and windows can be closed and sulphur candles burned overnight and if necessary over Sunday, so that the clothing of 400 men may be well disinfected once a week for the price of a few sulphur candles or other disinfectant.

The building is heated by steam radiators on the floor at the wall. Exhaust steam is used. The floor in the entire building is of concrete with a slight pitch to drain traps.

The hanger room is separated from the shower section, so that the water and steam from the showers will not condense on the clothes. This also enables the men to dress and undress without having water splashed over them, as is common in wash houses not so arranged.

The basins in the shower room were installed because there are always a few men at a mine who do not want to take a shower or who want to wash only their faces and hands. The basins with self-closing bibs were used instead of spigots in an effort to cut down the water consumption. The basins do get dirty, however, and require cleaning after each man, and it may be better to use a slow-flowing spigot instead.

FIREPROOF WASH HOUSE FOR 400 MEN

Material:		
Brick		$433.20
Corrugated steel for temporary end of hanger room		33.08
Barrett specification roofing		127.19
Mortar color		62.11
Cement		231.00
Millwork		47.25
Lumber		204.48
Hot-water heater and regulator		315.00
Clothes hangers		225.00
Miscellaneous hardware for hangers		75.00
Pipe, showers, lavatories for hot and cold water		313.40
Radiators and pipe for same		571.52
Sand and gravel for floors and foundations		105.97
Steel monitor and side sash		289.00
Glass for sash		58.00
Putty for sash		19.50
Lockers for bosses' wash room		23.50
Structural steel		399.86
15,000-gal. water tank, 3-in. flr, 12x16 ft., with steel tower		564 00
Drain tile and wall coping		53.71
Total material		$4,151.76
Labor:		
Unloading and hauling material	$114.41	
Foundations	178.85	
Installing steel	20.48	
Laying brick, mixing mortar, etc.	250.00	
Tank tower and foundations	154.00	
Roofing	251.10	
Plumbing, concrete floor, hangers, lockers, etc.	786.00	
Drain tile, conduits and piping to building	136.05	
Total labor		1,890.89
Labor and material cost		$6,042.65
Engineering		302.13
Total cost of wash house		$6,344.78

400 men at $6,344.78 = $15.86 per man, including bosses' bath and first-aid room.
400 men at $5,344.78 = $13.36 per man, excluding bosses' bath and first-aid room and cold-water facilities.

No data are available at present on the quantity of water used per man, but the equipment was figured on a basis of 30 gal. as a maximum, and it is hoped to get the quantity down to not more than 15 gal.

The cost of this wash house, including every item of expense incident to its construction and equipment, is given herewith, the figures being compiled from payrolls and invoices.

These costs are for a 400-man wash house arranged with a temporary end in the hanger room, so that the building could be extended to accommodate more men in units of 100. The first plan was for a 300-man house with extension for 100 more men, but before the walls were up the company decided to make it 400 to begin with and put in the temporary end so that the capacity could be further increased as the number of men employed increased. The mine now gives work to about 300 men, with a maximum number when fully developed of about 600.

The hanger system at this wash house has proved to be very satisfactory and much better than lockers, mainly because of the design of the building and use of the monitor sash, which permits good ventilation and rapid drying of the clothes.

With this system there is no accumulation of refuse and dirt, the building is sanitary, clean, warm and well-ventilated and can be washed and disinfected at practically no expense. As there is no regular attendant, a top employee devotes about half an hour each day to the regulation of ventilation by manipulation of the monitor-sash operating device and turns the hose on the floor. This labor cost, plus the cost of water and steam, is about the total for operation, but of course interest on investment and depreciation should also be charged against the plant.

Support for Overhead Pipe Line

An inexpensive method of supporting overhead pipe line is to employ a single line of supporting posts with the pipe suspended from crossarms. For a 3-in. steam line the posts could be similar to the sketch and spaced at about 11 ft. centers. Should they obstruct passageways over which a greater span is desirable, the span can be doubled and the middle of the span can be supported by a pair of truss rods.—*Power.*

Preventing Powder Headache

By Norman H. Squire*

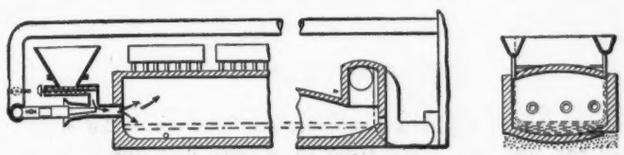
Many of the "powder headaches" from which miners suffer are the result of handling dynamite while loading holes. These headaches can be avoided by wearing rubber gloves when engaged in this kind of work. The most durable gloves are those made of heavy red rubber. This suggestion has given excellent results in the case of several of my acquaintances.

*Electrical engineer, Downieville, Calif.

Details of Milling and Smelting

Roasting-Matting of Copper Ores in Fine Condition

John H. Klepinger, Milo W. Krejci and Charles R. Kuzell, of Great Falls, Mont., have patented (U. S. Pat. 1,164,653) a process for smelting a charge of finely divided material such as copper-sulphide ore, by blowing into a reverberatory furnace the ore and other material in the presence of a supporter of combustion, such as pulverized coal, and regulating the air supply to maintain



SMELTING FLOTATION CONCENTRATES "ON THE WING"

oxidation of the sulphur and iron. The temperature of the particles is thus raised to the fusing point; a suitable quantity of unoxidized raw material is dropped in the bath to correct any over-oxidation that may have taken place in the original charge. It is thus intended to accomplish in a single operation the two distinct steps of roasting and matting as at present practiced. The process is considered especially adapted to the smelting of flotation concentrates.

The accompanying illustration presents the essential features of the process. The sulphide or other fine material and pulverized coal may be put in separate compartments of a feed hopper, and by means of screw feeder and compressed-air supply, will be blown into the furnace in practically the same manner as is the fuel in the present coal-dust fired reverberatory furnaces. The heavier mineral particles, however, require a greater air pressure to project them into the furnace and the coal-dust nozzles are hence not available for the best results.

The method is essentially an oxidizing process, and the heat of combustion derived from the oxidation of the combustible elements of the ore may be quite or nearly sufficient to maintain the proper working temperature. The object sought is to bring about the oxidation and fusing or smelting of the charge, while the particles are still in suspension. If over-oxidation of the ore particles occurs, a suitable proportion of raw concentrates, calcines or flue dust may be dropped from the side hoppers of the furnace, the unoxidized or lower oxidized condition of this material neutralizing the over-oxidation of the fused particles or bath at the bottom of the treatment chamber. As the heat margin is small when using air at ordinary temperatures, it is proposed to utilize the escaping gases from the furnace to dry the charge and to heat the blast, thus introducing hot air at the nozzles and increasing the temperature within the furnace.

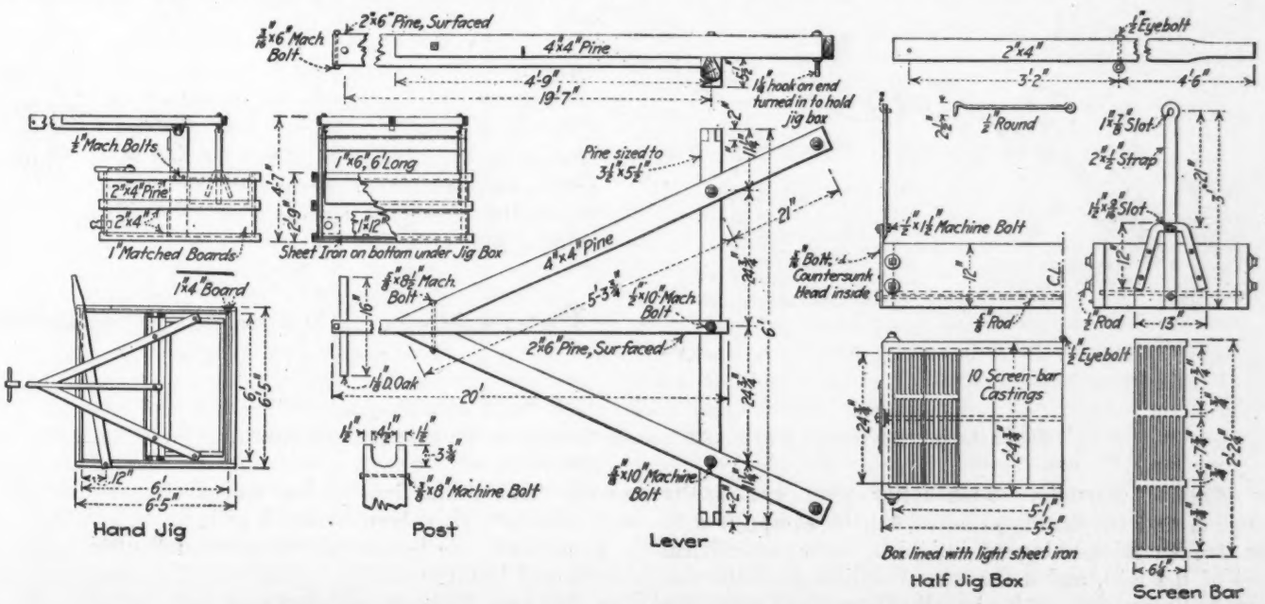
In an earlier patent (U. S. Pat. 1,160,621), the same inventors provided an apparatus, in which a reducing atmosphere was maintained, for the similar "smelting on the wing" of oxide fines.

A Joplin Hand-Jig

By C. K. Hitchcock*

There is much dissatisfaction among the prospectors in the Joplin district with the terms of liquidation and the methods adopted by the mills, therefore many of them turn to the hand-jig, by means of which concentrates may

*Mining engineer, 801 Chestnut St., Joplin, Mo.



DETAILS OF A HAND-OPERATED JIG AS USED IN THE JOPLIN DISTRICT

be produced on the ground. An additional reason for its use is that the cost of operation is between 50c. and 75c. per ton with the hand machine, including culling, whereas the mills charge between 75c. and $1, depending largely upon the haul.

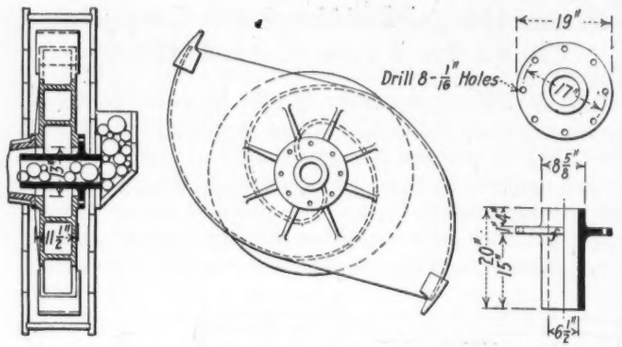
The loss in tailings through the use of these machines is very small, and extremely clean concentrates can be produced from free-milling ore. It is probable, in view of these advantages, that the hand-jig will be used as long as prospectors and small operators continue to be numerous in the Joplin district. The accompanying drawings show one of the most approved and efficient forms.

Regrinding at Anaconda

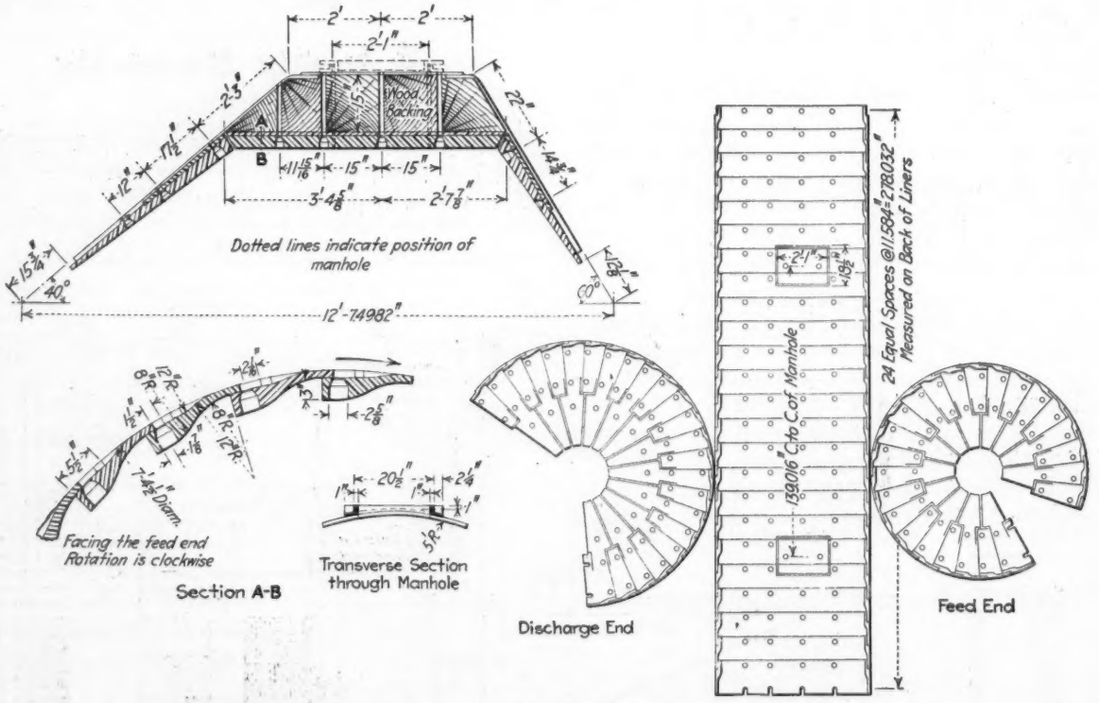
Some interesting expedients have been described by Laist and Wiggin in their description of flotation at the Anaconda concentrator, embodied in a paper to be read at the Arizona meeting of the American Institute of Mining Engineers, September, 1916.

At the time it was first decided to remodel the concentrator, it was not definitely known whether pebbles or steel balls would be used for grinding. To provide for this uncertainty a compromise was effected. The mills were made 10x4 ft. and built sufficiently strong for steel balls in case balls were used. Each mill was equipped with a 225-hp. motor directly connected through a flexible coupling. The mill filled with pebbles takes from 95 to 115 hp. to operate. In case steel balls were used, it was planned to put in a wooden false lining back of the steel lining in the cylindrical part of the mill to reduce its effective diameter. This latter plan was finally adopted, and the Hardinge mills will be equipped with the wooden false lining 15 in. thick, in the cylindrical part of the mill, and a Cascade steel lining. With this form of lining, the mill is virtually 7½x6 ft. and requires about 225 hp. when loaded with steel balls.

The drawing gives the details of the lining. It was designed by the American Manganese Steel Co. At first the pebbles, and later the balls, were fed to the mills through the feed scoop. This method of introducing the grinding medium into the mill gave considerable trouble, owing to the breaking of the feed boxes caused by the jamming of a pebble or ball between the revolving scoop and the feed box. We tried to obviate this difficulty by various changes in the amount of clearance left between the scoop and the box, but without success. In our particular case this trouble was aggravated by the fact that we had to use scoops 7 ft. in diameter in order to lift back into the mills the sand discharged by the Dorr classifier. Finally a method was tried of feeding the pebbles or balls through a spout passing through the center of the feed scoop. This device has worked splendidly, and all of our mills have since been equipped with it.



FEEDER FOR THE TUBE MILL



DETAILS OF WOOD BACKING AND FALSE LINING IN THE HARDINGE MILL

It prevents the breakages and other difficulties mentioned and is convenient in operation. The accompanying drawing shows its arrangement and indicates the facility with which it solves the problems presented.

Company Reports

Report of Tomboy Gold Mines

The general manager's report of the Tomboy Gold Mines, Telluride, Colo., for the year ended June 30, 1915, states that 145,857 dry tons of ore were treated, yielding $1,027,524, or $7.05 per ton. Expenses amounted to $654,647, and profits were $372,877. The following is a summary of receipts and expenditures:

RECEIPTS AND EXPENDITURES

145,857 dry tons ore milled, yielding bullion worth			$414,114.06
Concentrates worth			537,494.90
Cyanide bullion worth			75,915.43
Dividends from the Tomboy Tramway and Tunnel Co			10,000.80
Boarding house, rents, etc			13,345.52
			$1,050,870.08
Mining and development expenses,	$2.44 per ton	$356,041.58	
Milling expenses,	.53 per ton	77,240.31	
Concentrating expenses (including transportation to railway)	.48 per ton	69,650.21	
Water-supply expenses,	.09 per ton	13,582.65	
Assay-office expenses,	.03 per ton	4,918.75	
Cyaniding expenses (at $0.90 per ton of tailings treated),	.45 per ton	64,984.10	
General expenses,	.24 per ton	35,037.56	
Taxes and insurance,	.23 per ton	33,192.26	
Total expenses,	$4.49 per ton		$654,647.42
Surplus			$396,222.66

Ore reserves in the Argentine group are estimated to contain 185,000 tons, of which 135,000 tons is broken in stopes. The Montana group is estimated to have 350,000 tons, of which 200,000 tons is broken in stopes. No estimate of the grade of this ore is given.

The cyanide plant was started about the middle of December, 1914. From a mechanical point of view it has given satisfaction, but the extraction has been much lower than expected, judging from preliminary experiments. Operations indicated that the agitators would require a more dilute pulp. This has necessitated the addition of more filter capacity.

Consolidated Mining and Smelting in 1915

The annual report of the Consolidated Mining and Smelting Co. of Canada, operating at Trail, B. C., for the year ended Sept. 30, 1915, shows a profit of $795,411 from a total revenue of $7,506,098. Receipts were made up of $6,349,651 from sale of smeltery products, $179,448 from smeltery products in transit, $966,865 from ores and metals on hand and $10,134 from rents and sundry revenue. The principal items of expense were: Charge for product on hand at first of the year, $1,453,251; custom ore, lead and bullion purchased, $1,400,000; freight on ore from company's mines, $151,443; mining, smelting and general expense, $3,063,716; development expense, $435,231; depreciation of general plant and equipment, $192,479; directors' fees, $8,800; sundry items written off, $5,767. Plant account was increased $142,430 and property account $42,372 during the year. The following table gives the smeltery production:

TRAIL SMELTERY PRODUCTION

	Tons Ore Smelted	Ounces Gold Produced	Ounces Silver Produced	Pounds Lead Produced	Pounds Copper Produced	Gross Value
1894 to date	4,372,886	1,610,903	22,247,832	374,091,124	63,196,978	$73,402,078
1914 to 1915	447,064	148,891	2,230,500	40,177,910	5,306,184	6,898,744

The total expenditure on plants for the year amounted to $334,909 and was spent principally for the extension, Cottrell plants for the lead roasters and furnaces, an additional lead furnace, an additional crane in the Huntington & Heberlein plant, washhouses for men at lead plant, a new lead-sampling mill, copper converters and several alterations. After considerable experimental work on the treatment of zinc, a 25- to 35-ton spelter plant is being erected for the production of electrolytic zinc.

Temiscaming & Hudson Bay

The report of the Temiscaming & Hudson Bay Mining Co. for the year ended Aug. 31, 1915, states that the only work done on the Hudson Bay mine, South Porcupine, Ont., was in the neighborhood of the Cobalt Lake fault. Diamond drills were used to test the depth and extent of the conglomerate formation. So far no pay ore has been encountered. The company is holding some claims by assessment work in the Kirkland Lake district.

At the Dome Lake mine of this company active mining and milling operations were carried on throughout the year. At the Hudson Bay mine expenditures totaled $15,595 for development and diamond drilling. Drifting 298 ft. cost $14.43 per ft., and 446 ft. of crosscutting cost $13.56 per ft. Not including depreciation or head-office administration, mining operating costs at the Dome Lake averaged $3.90 per ton and mill operating costs $2.25 per ton. The mill treated 9,318 tons of ore, leaving a head assay value of $9.91 per ton; tailings averaged $2.04 per ton, giving an extraction of 79.41%. The total value of the product recovered was $76,521, of which $63,998 was recovered by amalgamation and $12,523 by concentration. At present no cyanide treatment is given the ore.

The Temiscaming & Hudson Bay Mining Co. paid $23,283 in dividends during the year, making a total of $1,940,250 in dividends to date.

Beaver Consolidated

During the quarter ended Nov. 30, 1915, the Beaver Consolidated Mines, Cobalt, Ont., completed the addition to its mill and is now treating from 125 to 150 tons a day. Development work amounted to 1,089 ft. and 2,580 cu.yd. was stoped. Diamond drilling has proved that the lower contact between the diabase and Keewatin formation exists at between 1,600 and 1,700 ft. from the surface. Sinking is to be resumed as soon as possible to reach this contact. At the end of the quarter the company had 220,015 oz. of silver and $122,674 cash on hand. Of the silver 57,296 oz. was in storage and the remainder was contained in ore at the smelteries, in transit or bagged at the mine. A dividend of $60,000 was paid Oct. 15.

The company has taken an option on the Kirkland Lake Gold Mines in the Kirkland Lake district north of Cobalt. One of the claims of this company, known as the McKane lot, touches the Teck-Hughes, which is now

being operated by the Buffalo Mines of Cobalt. This company is erecting a mill. The Tough-Oakes mine, a little over a mile away from these properties, is now producing about $80,000 a month and has paid two dividends. It is stated that all these properties lie in the same mineralized zone. The Beaver Consolidated is spending about $2,000 per month in development on the Kirkland Lake.

Stratton's Independence

The report of the Stratton's Independence, Cripple Creek, Colo., for the year ended June 30, 1915, chronicles the end of Stratton's Independence mine so far as its identity is concerned, the company having sold it to the Portland Gold Mining Co. for $372,000 on June 30. The gross production of the company to June 30, 1915, is stated as follows:

By late W. S. Stratton	$3,985,400
By first English company operating on company account, 1898-1904	11,049,030
By the same company operating by lessees, 1904-08	4,015,290
By the present company, 1908-15	4,571,968
	$23,621,728

The earnings of the mine and the ore produced and sold, as stated in the report, follow:

THE EARNINGS OF THE MINE

Profit by Mr. Stratton	$2,402,164
Dividends by first English company, 1898-1904	4,142,739
Dividends by the same company leasing, 1904-08	606,250
Dividends by the present company	455,625
Cash as at Sept. 30, 1915 (approximately)	510,000
	$8,116,778

ORE PRODUCED AND SOLD

	Tons
By W. S. Stratton	41,694
By first English company	323,270
By first English company, lessee	104,040
By the present company	104,729
Total shipping ore	573,733
Ore milled by the present company, 1908-15	685,130
Total production to June 30, 1915	1,258,863

In 1907 Philip Argall, the consulting engineer, made a report to the company estimating that its dump ores could be treated at an operating cost of $1.52 per ton, treating 10,000 tons a day, and 70% recovery based upon tests indicating 74.22% recovery. In making this estimate Mr. Argall figured $3.60 per ton as average grade based upon previous sampling indicating about $3.80 per ton. The actual average by milling was $3.044 per ton. The following table is a six years' summary of milling operations on these dump ores:

Years	Tons	Assay per Ton	Total Ounces	Extd. %	Cost	Per Ton Cost
1909-10	68,711	0.16150	11,097.750	67.87	$122,914.12	$1.7880
1910-11	109,800	0.15700	17,288.960	71.50	180,340.25	1.7330
1911-12	112,391	0.15500	17,428.215	73.63	167,710.65	1.5000
1912-13	130,110	0.15380	20,012.929	78.48	184,186.52	1.4400
1913-14	133,875	0.14396	19,273.469	80.00	184,898.31	1.3800
1914-15	116,778	0.14680	17,146.607	75.97	176,717.28	1.5130
	671,665	0.15220	102,247.930	74.57	$1,016,767.13	$1.5138

Wettlaufer Lorrain

The Wettlaufer Lorrain Silver Mines, Cobalt, Ont., for 1915 reports that no mining operations were carried on during the year. The plant and equipment were kept in order and the mine was kept free of water above the fourth level.

The company is trying to find a new mining property sufficiently attractive for purchase. In the Porcupine District it has examined the Nighthawk Lake, Sesekinika, Goodfish Lake, Boston Creek, Gauthier, McVittie and Coleman Townships; some of these properties offer encouragement for further investigation, but no options have yet been taken. The company, in connection with the Kerr Lake Mining Co., is exploring and making an examination of the St. Anthony Gold Mining Co., Sturgeon Lake, Ont. The income and expenditures statement shows expenditures were $3,822 over receipts.

Helvetia Copper Co.

A statement issued Oct. 4, 1915, by the president of the Helvetia Copper Co. states that since operations were suspended in 1911 the property has been in charge of a caretaker to keep the equipment in repair. A superintendent is also employed to look after company affairs in Arizona. The annual overhead charges with the property idle have averaged $6,183 during the last four years.

During the high price of copper some copper-bearing material has been shipped, which has netted $1,659. With the present demand for molybdenite ores, the company has marketed some of this ore from a small deposit in the Leader mine. These sales have netted $1,891, and there are approximately 100 tons left, which should net about $26 per ton.

No attempt will be made, however, to reopen and operate the Helvetia Copper Co.'s mine, as experience has shown that a railroad from the mine to Vail, Ariz., is necessary before the mine can be operated at a profit. This would cost about $279,000, and to provide for this and other expenses of reopening, etc., would require an assessment of at least $2.50 per share of stock.

Sante Fe Gold and Copper

The annual report of the Santa Fe Gold and Copper Mining Co., San Pedro, N. M., for 1915 shows a production of 3,376,246 lb. of matte containing 1,747,090 lb. of copper, 24,570 oz. of silver and 2,104 oz. of gold. The total cost of producing refined copper was 10.6c. per lb. after crediting the gold and silver to expenses. The property was idle five months, and the remaining seven months' operations showed a profit of $141,430, not including depreciation amounting to $50,000.

Actual operation of the smeltery started on May 24, and since then a considerable amount of exploratory work has been done in the mine. Considerable work was done on the 300-ft. level to find the "high-grade" orebody opened on the level above, but so far the ore developed has been lower in grade.

The Premier Diamond Mining Co. in the Transvaal, although it was not able to resume mining and washing operations in the last financial year, nevertheless managed to dispose of a considerable portion of the stocks on its hands when the war broke out. Moreover, the report states that in view of the reduction in stocks and the increased demand it has been decided to resume washing operations on a small scale. "Some time must elapse," the report goes on to say, "before any fresh diamonds can be shipped and placed upon the market, when, it is hoped, the bulk of the existing stocks will have been absorbed." As a result of the sales that have taken place during the year the shareholders' appropriation account shows a credit balance of £54,626 as compared with a loss of £13,245 a year ago. The company's preference dividends have not been distributed since April, 1914, and there is no immediate prospect of their resumption. The directors record that it was only by coöperation and agreement among the great producers that a resumption of partial activity became possible, and as regards the future they venture the opinion that "much closer relations will have to be established amongst the great producers to limit the output and maintain and increase prices so as to assume reasonable profits."

Mineral Production of Canada

SYNOPSIS—Abstract of preliminary report by John McLeish, chief of Division of Mineral Resources and Statistics, Mines Branch, Department of Mines, giving quantities and values of the minerals and metals produced in Canada in 1915. The total value was $138,513,750, the largest ever reported, with one exception.

As a result of the demand created by the war, the metal-mining industry has in 1915 shown the highest production ever recorded, and notwithstanding the greatly decreased production of materials of construction, such as cement, clay and stone quarry products, a very large increase is still shown in the total mineral output, over that of the previous year.

Without attempting to discuss at length the effect of the war upon the Canadian mining industry, it may be remarked that the demand for copper, lead, nickel and zinc led to great activity in the operation of the already developed deposits of these metals and also, later in the year, to the opening up of old and the exploitation of new deposits. The capacities of steel furnaces were taxed to the utmost to meet the demand for shell steel.

The fact that under war conditions it was desirable that our metals should become available for commercial or national use entirely within the country and that we should be less dependent, even upon a friendly neutral, for their recovery in smelteries and refineries has stimulated the development of our smelting and refining operations.

Among nonmetallic minerals the recovery of benzol and toluol in byproduct coke-oven operations was a direct result of the war, as was also the activity in the mining and shipment of magnesite and of chrome ores.

The limitation placed by the government upon the export of certain minerals and metals may have caused inconvenience and interruption to certain industries, but these were usually adjusted by the issue of special licenses for export where it could be shown that such export was not for enemy destination but was in the interest of Great Britain and her allies.

The larger gains in metal production, as compared with 1914, were 49.6% in nickel, 35.5% in copper and 24.9% in lead. The only loss was 0.2% in silver.

Gold and Silver

The total production of gold was 916,076 fine oz., or $18,936,971, of which about $5,550,987 was derived from placer and alluvial mining, $9,195,307 in bullion and refined gold and $4,230,677 contained in matte, blister copper, residues and ores exported. The output in Nova Scotia was about $137,178, or over twice that of the previous year. Ontario has now become the largest gold-producing province, the production in 1915 from 15 properties being reported as $8,386,956, or 44% of the total in Canada. The Hollinger and Acme mines contributed about one-half of the output in 1915 and the Dome nearly one-fifth of the total. From Alberta record has been obtained of the recovery of about $4,000 of alluvial gold. The production in British Columbia was $5,628,982 including $755,000 estimated by the provincial mineralogist as being the output of placer workings, and $4,873,982 recovered from milling and smelting ores. The Yukon production in 1915, including a small recovery from copper ores, was $4,755,721, a decrease of $369,653 from 1914.

The production of silver was 28,401,735 oz. valued at $14,088,397, as against 28,449,821 oz. in 1914, valued at $15,593,630. The falling off in quantity was very small, however, amounting to only 48,086 oz. Owing to the lower price of silver the decrease in total value was $1,505,234. Of the total production in 1915, about 86.8% or 24,653,057 oz. is credited to Ontario.

The production from the ores of Cobalt and other silver camps was 23,568,147 oz., including 19,893,639 oz. in bullion recovered in smelteries and cyanide plants in Canada and 3,674,508 oz. estimated as recovered from ores exported to United States smelters. The quantity credited to gold ores was 84,910 oz. The production in British Columbia, representing refined silver, silver contained in smeltery products and estimated recoveries from ores exported, was about 3,628,727 oz. In Quebec there is a small amount of silver in the pyrite ores shipped, while 58,382 oz. is estimated as being recovered from copper ores and placer gold in the Yukon.

The copper output in 1915 was the highest recorded. The production in smelteries, together with the estimated

TABLE 1. MINERAL PRODUCTION OF CANADA IN 1915

Subject to Revision

Product	Quantity	Value
Metallic:		
Antimony, lb.	961,040	$192,208
Cobalt, metallic, lb.	211,610	502,388
Cobalt, oxide, lb.	379,219	
Nickel, metallic, lb.	55,325	42,193
Nickel, oxide, lb.	200,032	
Copper, lb.	102,612,486	17,726,307
Gold, oz.	916,076	18,936,971
Iron, pig, from Canadian ore, tons.	158,598	1,740,808
Iron ore, sold for export, tons.	93,444	187,682
Lead, lb.	45,377,065	2,541,116
Molybdenite, lb.	28,600	28,460
Nickel, lb.	68,077,823	20,423,348
Silver, oz.	28,401,735	14,088,397
Zinc ore, tons.	15,553	636,204
Total.	.....	**$77,046,082**
Nonmetallic:		
Actinolite, tons.	220	82,420
Arsenic, white, tons.	2,291	141,830
Asbestos, tons.	113,115	3,491,450
Asbestic, tons.	25,700	21,819
Chromite, tons.	11,486	162,618
Coal, tons.	13,209,371	31,957,757
Corundum, tons.	262	33,138
Feldspar, tons.	15,455	59 124
Graphite, tons.	2,610	121,023
Grindstones, tons.	2,580	35,768
Gypsum, tons.	470,335	849,928
Magnesite, tons.	14,779	126,535
Manganese, tons.	47	5,460
Mica, tons.	.....	81,021
Mineral pigments:		
Barytes, tons.	550	6,875
Ochres, tons.	6,248	48,353
Mineral water.	.....	118,796
Natural gas, M cu.ft.	18,319,710	3,300,825
Peat, tons.	300	1,050
Petroleum, bbl.	215,464	300,572
Phosphate, tons.	217	2,502
Pyrites, tons.	296,910	1,028,678
Quartz, tons.	127,108	205,153
Salt, tons.	119,900	600,226
Talc, tons.	11,885	40,554
Tripolite, tons.	317	12,119
Total.	.....	**$42,755,591**
Structural Materials and Clay Products:		
Cement, portland, bbl.	5,681,032	6,977,024
Clay products.	.....	3,918,200
Kaolin, tons.	1,300	13,000
Lime, bu.	4,932,767	1,015,878
Sand and gravel.	.....	2,098,683
Sand-lime brick, number.	23,211,802	182,651
Slate, square.	397	2,039
Stone.	.....	4,504,599
Total structural materials and clay products.	.....	**$18,712,074**
Grand total, 1915.	.....	**$138,513,750**

recoveries or amounts paid for in ores exported, amounted to 102,612,486 lb. Of the total 42,050,347 lb. was contained in blister copper, 44,230,052 in copper and copper-nickel matte and 16,332,087 recovered from ores exported. By provinces 6,082,003 lb. was from Quebec; 39,303,279 lb. from Ontario; 56,692,988 lb. from British Columbia; 534,216 lb. from the Yukon.

The nickel production is shown in the accompanying table. Aside from the heavy increase there was no change in conditions, the matte produced at the mine smelteries being shipped to the United States and Great Britain to be refined.

Lead and Zinc

Although there was an increase of nearly 25% in the production of lead, the 1915 output has been exceeded in 6 of the past 15 years. The production of lead in 1914 was 45,377,065 lb. The 1915 output consists chiefly

TABLE 2. MINERAL PRODUCTION BY PROVINCES

	1914		1915	
	Value	Per Cent. of Total	Value	Per Cent. of Total
Nova Scotia	$17,584,639	13.68	$18,126,672	13.09
New Brunswick	1,014,570	0.79	916,329	0.66
Quebec	11,836,929	9.21	12,159,436	8.78
Ontario	53,034,677	41.01	61,800,178	44.62
Manitoba	2,413,489	1.88	1,351,604	0.97
Saskatchewan	712,313	0.55	395,728	0.28
Alberta	12,684,234	9.87	9,915,282	7.16
British Columbia	24,164,039	18.80	28,932,658	20.89
Yukon	5,418,185	4.21	4,915,863	3.55
Dominion	$128,863,075	100.00	$138,513,750	100.00

TABLE 3. PRODUCTION OF NICKEL IN CANADA

	1913 Tons	1914 Tons	1915 Tons
Ore mined	784,697	1,000,364	1,364,048
Ore smelted	823,403	947,053	1,272,283
Bessemer matte produced	47,150	46,396	67,703
Copper content of matte	12,938	14,448	19,608
Nickel content of matte	24,838	22,759	34,039
Spot value of matte	$7,076,945	$7,189,031	$10,352,344

TABLE 4. COAL PRODUCTION IN CANADA

Province	1913 Tons	1914 Tons	1915 Tons
Nova Scotia	7,980,073	7,370,924	7,429,888
British Columbia	2,714,420	2,239,799	2,089,966
Alberta	4,014,755	3,683,015	3,320,431
Saskatchewan	212,897	232,299	236,940
New Brunswick	70,311	98,049	122,422
Yukon	19,722	13,443	9,724
Total	15,012,178	13,637,529	13,209,371

TABLE 5. ANNUAL MINERAL PRODUCTION IN CANADA FOR 30 YEARS

(In Values)

1886	$10,221,255	1901	$65,797,911
1887	10,321,331	1902	63,231,836
1888	12,518,894	1903	61,740,513
1889	14,013,113	1904	66,082,771
1890	16,763,353	1905	69,078,999
1891	18,976,616	1906	79,286,697
1892	16,623,415	1907	86,865,202
1893	20,035,082	1908	85,557,101
1894	19,931,158	1909	91,831,441
1895	20,505,917	1910	106,823,623
1896	22,474,256	1911	103,220,994
1897	28,485,023	1912	135,048,296
1898	38,412,431	1913	145,634,812
1899	49,234,005	1914	128,863,075
1900	64,420,877	1915	138,513,750

of pig and manufactured lead produced at Trail, B. C., but includes also an estimate of the lead probably recoverable from ores shipped to smelteries outside of Canada. The entire output of the Surprise mine in the Slocan District, B. C., was shipped to the United States, refined in bond, and sold in London.

Complete returns of zinc shipments have not yet been received, but the tonnage is estimated at 15,553, containing 12,400,000 lb. of zinc. Shipments include several hundred tons from Notre Dame des Anges, Que., but the greater part is from some 15 properties in British Columbia.

After several years of no production the demand and high prices in 1915 caused a renewal of activity in mining antimony ores at West Gore, N. S., and Lake George, N. B. About 1,288 tons of concentrates were shipped to England from the former locality. The antimony smeltery at Lake George was operated toward the end of the year with a small production of refined antimony, and there was also some recovery of refined antimony at the lead refinery at Trail, B. C.

Metallic cobalt is now being recovered as well as cobalt oxide at the smelteries at Deloro and Thorold. The silver-cobalt-nickel ores of the Cobalt district are reduced in these smelteries, silver being the principal product, with arsenious oxide, metallic cobalt and nickel, cobalt oxide and nickel oxide as byproducts.

A production has been reported of about 28,600 lb. of molybdenite valued at $28,460, including cobbed molybdenite and molybdenite contained in ore shipped to concentration plants. There was also about 50 tons of low-grade ore sent to the Mines Branch ore testing laboratories for experimental concentration.

Efforts are being continued to recover platinum from the gravels on the Tulameen River in the Similkameen district of British Columbia, and there is also occasional recovery of small quantities from the gold gravels of Quesnel division, Cariboo district. A recovery of about 20 oz. is reported in 1915. There was no recovery of platinum from the Sudbury nickel-copper mattes.

Iron and Steel

Iron ore shipments in 1915 amounted to 398,112 short tons and included hematite, 205,989 tons; roasted siderite, 132,906 tons; cobbed magnetite and concentrates, 59,217 tons. Shipments of iron ore from Wabana mines, Newfoundland, in 1915, by the two Canadian companies operating there were 868,451 short tons, of which 802,128 tons was shipped to Cape Breton and 66,323 tons to England.

The total production of pig iron in Canadian blast furnaces in 1915 was 913,719 short tons. A large proportion of this is used directly in the manufacture of steel. Of the total, 13,692 tons was made with charcoal and 900,027 tons with coke. Included in the ore charged to blast furnaces there were 293,305 short tons from Canadian mines and 1,463,681 tons of imported ore. Of the imported ore approximately 840,587 tons came from Newfoundland. Of the pig iron reported, 420,219 tons was made in Nova Scotia and 493,500 tons in Ontario.

The production of steel ingots and castings in 1915, including 5,626 tons from electric furnaces, was 1,020,335 short tons, as compared with a production in 1914 of 828,641 tons.

Coal and Miscellaneous Minerals

The production of coal by provinces is given in the accompanying table. Exports of coal in 1915 were 1,766,543 tons; imports, 12,465,902 tons.

Asbestos mining flourished. There was a revival in chrome ore and magnesite, while the mining of pyrites increased.

Butte & Superior Copper Co.

The report of the Butte & Superior Copper Co., Ltd., for the last quarter of 1915 shows production of 43,563,144 lb. of zinc in concentrates. Of ore there was 150,150 dry tons milled, containing 16.66% Zn and 7.04 oz. silver per ton. The average silver in the concentrates, 44,344

tons of which were produced, was 21.42 oz. per ton. The recovery of zinc in concentrates amounted to 95.07%.

The total cost per ton was $5.1288—$3.5373 for mining and $1.5915 for milling. Total profits amounted to $2,760,039, to which may be added metal inventories of $333,759. A new office building and warehouse have been constructed, and an automatic sprinkler system has been installed for fire protection throughout the mill, shops, compressor plant, engine room and warehouse.

The Rush Zinc District

SPECIAL CORRESPONDENCE

After many trials and vicissitudes I have arrived home from the flooded Arkansas. Until recently the Rush, Ark., zinc district has been considered relatively unimportant, but it has some advantages which should give it a higher place. I found there J. C. Sheppard, son of "Boss Sheppard," who was invited to leave Mexico. He started as a miner at Rush and now has two mills and four leases. To get to Rush I crossed Rush Creek 43 times and when not in the creek was on the worst road ever, the ground being cut hub-deep and frozen. A storm on the ocean was not a circumstance to a ride in the stage. I walked three of the 12 miles and would have been pleased to have walked more, but the darned creek kept getting in the way. To add to my discomfort, the temperature was 16 above and the breeze brisk. Rush is where wolves swoop down on the farmers raising pigs. The man whose property I went to see had 43 little razorbacks killed the night before I reached there. Sheppard has two tame wolves for pets. J. T. Fuller, who was at Kimberley, South Africa, and was more recently state geologist of Arkansas, is now running a zinc mine, although he is not at Rush, but some distance away.

The orebed being worked is above water level and is as regular in strike as a coalbed, thus making prospecting a comparatively easy matter. There is no iron or lead in the ore, thus smelting penalties are avoided. At those mines supplying mills stoping is done with air drills, the stope being carried in two benches to a height of about 20 ft. Few blank shots are fired, which speaks well for the deposit. A wrinkle which may be of value to others using hammer drills and which at least is of importance in this field is to close the hole at the end of the bit and drill it in the side. This saves steel and at the same time clears the hole of cuttings as satisfactorily as when an opening is left in the end of the steel. At present the Morning Star, Mackintosh, Red Cloud, Philadelphia and Silver Hollow mills are crushing ore; the Yellow Rose and Sure Pop mills have just been completed; the Edith is under construction, and one or two other mines are contemplating the erection of mills. Those mills on Rush Creek and Buffalo River are sure of a water supply the year around.

In addition to the mines with mills, there are mines and prospects without mills that are at present shipping what is termed open ore—that is, ore composed of blende and silicate. This ore is cobbed and brings from $60 to $80 per ton at the furnaces, depending on the analysis. Rush is handicapped by transportation facilities, being 12 mi. from Yellville one way and 9 mi. from Buffalo the other way. The cost of wagon haulage is 15c. per cwt., and the carters earn it. Wood is $4 per cord, and a 150-ton mill will consume about 8 cords per day during the winter time.

The system of milling followed is crushing to about 1½ in. in jaw crushers, sending this product to coarse rolls, then to screens. The undersize goes to the coarse jigs, the oversize to fine rolls, and so on down the line. The last operation is treating the slimes on tables. Most of the coarse slime product is zinc silicate and to separate it from the sand requires fine adjustment, the two being so nearly of the same specific gravity. If the two railroads contemplated are constructed this year, Rush Creek zinc district will be of some importance as a producer. A short time ago the population was 80; now it is about 2,000, most of the people living in tents.

Where the Air Goes

BY HARRY E. SCOTT*

We hear many complaints about the inefficiency of air compressors at every mine, no matter how large or how small the mine or the compressor. This is not surprising when you take into consideration the fact that in many places the compressor while running only 6 drills has to supply enough air for 10, because of the loss by leaks in pipes and hose.

The leaks being small, it is not believed that the loss is serious, so it is disregarded for a few days until the hole is so large that it has to be repaired. This takes just as much time as it would in the beginning, and is only done after a loss of air that should have been used to run the drills.

The majority of the small companies install a compressor just large enough to do the work at that time, which is proper; but as the mine progresses and more work is crowded on the machine by the installation of other drills, the compressor is overloaded and cannot do the work. Then the trouble starts—first with the most proficient of all kickers, the drill runner, then up the line it goes to the proper official, and he in turn goes after the machinery company. But is it the fault of the compressor? The foregoing is only one of the many reasons for poor air and the so-called inefficiency which, when investigated, are usually not the fault of the compressor, but due to the conditions found in most mines.

In the following paragraphs I will enumerate some of the causes for air losses that I have found in the mines of the West and Southwest in the many long years I have followed the game. Some of these offenses I plead guilty to in the days before I got the efficiency bird on my perch.

A CASE OF CARBONIZATION

Several years ago I went to an isolated camp on the desert. There was a small compressor that had been run by about 30 men, as near as I could find out, in the 1½ years it had been in use. The blacksmith would start it in the morning, and when he became tired, his helper would take his place. If they both had other work to do, a miner, mucker or a machineman who was not feeling well enough to go underground was put on for a few days to rest up. During the busy season, when none of these was available, or when stockholders were visiting, the superintendent or foreman would take a chance at it. The compressor was large enough to run seven drills the

*Morenci, Ariz.

size they were using and keep 100 lb. pressure without getting hot.

At the time I arrived on the scene only three drills were running, carrying 60 lb. of air. You could fry pork chops anywhere on the compressor or motor. Taking advantage of a shutdown the second day on the job, I examined the cylinders and valves. It was a miracle that the receiver and the machine itself had not gone heavenward in small pieces. It was carbonized wherever possible for it to be so and I had to cut one of the outlet valves loose with a chisel. After a shift's work with two helpers, cleaning, filing and scraping, the compressor was started the next morning, carrying 80 lb. of air. The second day 90 lb. pressure was carried and the third day 100 lb., every part of both the compressor and the motor running as cool as any small high-speed machine. This compressor had been the source of much trouble between the mining company and the makers for months. This stopped when it was cleaned and given a chance to do its work.

This is not the only windjammer I have met in this condition. I have seen many of them, especially the smaller ones, which do not usually get an even break. The compressor is installed properly and run two or three months, when the compressor man quits. Of course a new one is needed and the superintendent has an old friend or the foreman has a brother-in-law who left home and the plow a few months before. The plow and grindstone are the only machines he knows anything about. He has worked underground a few months, mucking and carrying steel for the machineman and is a full-fledged miner now. It is pretty hard on the young fellow, so he is taken out of the mine and put on the compressor with the injunction, "Keep plenty of oil on it and you will get along all right." He uses about three times the oil he should, and in a short time the cylinders are running pretty hot. It needs oil, he thinks, so in goes a double dose and down goes the efficiency. I do not say the young man should not have had a chance, but he should have been broken-in properly.

At one place at which I was employed there was much argument between the master mechanic's office and the mine department about the air. The mine men claimed they were not using as much air on the drills and air hoists as was being charged to them. I made some tests that surprised some of the bosses who had been letting the

TESTS FOR LEAKS IN COMPRESSED-AIR CONNECTIONS

First Test			Second Test	
Pressure, Lb.	Loss, Free Air, Cu.Ft. per Min.	Hose Repairs	Pressure, Lb.	Loss, Free Air, Cu.Ft. per Min.
90	3.36	2 gaskets on connections	90	00
95	105.29	2 gaskets on connections	90	6.95*
90	42.00	2 small leaks	90	00
85	38.75	1 small leak	90	00
		Air Drill Repairs		
Jackhamer 85	79.0	Cleaned and oiled.....	85	63.0
Stoper.... 95	101.4	Cleaned and oiled.....	90	75.6
Piston.... 90	182.0	Overhauled, leather.....	90	125.7

* This hose was full of small holes and could not be repaired, but by putting on two new rubber gaskets, over 98 cu.ft. of free air was saved each minute that the air was turned on, as it leaked just the same whether drill was running or not.

small leaks go. These drills and hose were taken out of the mine just as they were being used, with the same connections. On arrival at the shop the first test was made, and then repairs. After that a second test was made, and it showed where much of the disputed air, if not all of it, was going. These tests were made at 5,000 ft. altitude and one-minute runs.

These were not exceptional hose or drills, nor selected tests. They were the first we came to on entering the mine. The tests show enough air going to waste in the 4 hose to run 3 drills of the jackhamer type. If in fair condition, none of them need have been out of the stope more than 30 min. for repairs, but it seems to be the opinion of the modern shift bosses that it has to be "rock in the box" to pay dividends, regardless of how they get it. A drill or hose cannot lose time enough to be kept in condition; they do not consider the extra fuel at high cost which it takes to make this air that is doing nobody any good.

These things occur, not in one mine only, but in many of them—particularly the smaller ones, where the saving is more important than in the large dividend payer.

I do not believe that there is a superintendent who has enough fingers to count the leaks he sees or hears in the pipe lines on a single trip through a mine where a number of drills are working. The fault of the compressor and air drills is not with the makers so much as with the managers of the mine, who neglect the leaks in both the hose and the pipe lines and try to make a 10-drill compressor run 10 drills while throwing away enough air through leakage to run four more.

Canadian War Tax on Mines

EDITORIAL CORRESPONDENCE

The suggestion of the Canadian Minister of Finance to levy a retroactive tax upon mining in the Dominion of Canada has met with strenuous and undivided opposition on behalf of all who are connected with the mining industry in any way, and in addition, by many business men of Canada, who see in this tax a blow to the mining industry that will reflect seriously upon the general commercial prosperity of the country. Although no definite bill has yet been formulated, the proposition is to levy a tax of 25% on all profits above 7% on the capital of any mining corporation that is capitalized at more than $40,000. In addition, it is proposed that the time during which the tax may be collected shall retroact to March, 1915.

At a meeting of the Canadian Mining Institute on Mar. 1, the matter of this mining tax came up and was discussed in detail. P. A. Robbins, manager of the Hollinger, pointed out that the Hollinger and its affiliated concerns would pay $\frac{1}{16}$ of the entire tax to be levied in the whole Dominion, an amount running up to about a million and a quarter of dollars. Mr. Robbins said he had seen Sir Thomas White, the Finance Minister, about the matter, and that his idea seemed to be a broad tax that would bear upon all industries of the Dominion, but he did not seem to know much about actual mining. It was pointed out that the capital stock of a mining company does not necessarily bear any relation either to its profits or to the value of the property. It merely represents somebody's hope of what it may be worth some day, and many mining companies would have a capital small enough to come under the minimum set by this new law and yet would be earning a great deal more money than many others whose capital is ten or a hundred times as much. The only guide the Finance Minister had was the gross output of mines, and he seemed to think there was some relation between capitalization and production. He seemed also to think that war conditions had increased the profits in mining, whereas on gold and silver, the profits had been considerably reduced.

In the great amount of discussion that followed—participitated in by A. J. Young, of North Bay; Frank Oliver, President of the Temiskaming and Beaver Mines; A. B. Clabon, of Toronto, and many others—the opinion was unanimous that the tax was unfair. It must not be thought, however, that the mining industry of Canada wishes to avoid paying its just share of any tax, but is willing to pay an equal tax no matter how heavy. It does feel, however, that the basis of this proposed law is unjust. It has already had the effect of lessening the value of many of the stocks of mines that would be affected by the tax and has resulted in an absolute cessation of investment in mines in Canada.

Proposed Electric Tin Smelting

The South American Electric Smelting Co. has been organized to take over the equipment of the Standard Smelting Co., which was organized at Pittsburgh about a year ago for the smelting in this country of low-grade tin-bearing metal, and latterly of Bolivian tin concentrates, says *Iron Age*, of Mar. 2, 1916. Minor C. Keith, of the United Fruit Co., is president of the South American Electric Smelting Co., and H. M. Keith is treasurer.

It is further stated by the same authority that the owners of the patents of the Wile Electric Furnace Co., of Pittsburgh, have agreed to place a furnace in Bolivia and have it in operation within eight months from last November, "in order to kill certain legislation that had been introduced for the exclusive smelting and water-power rights for 25 years; it was to carry out this obligation that the new company was formed and the operations of the old company stopped. It is proposed to install three furnaces of 10-ton capacity to take care of the tonnage guaranteed by certain interests at this plant."

It is expected that additional furnaces will be installed later, but these will not all be put in one place on account of the difficulty of shipping ores to one spot. The three initial furnaces are expected to be shipped by Mar. 18 and to be in operation by June 1. R. S. Wile, president of the Wile Electric Furnace Co., expects to leave soon for South America to superintend the building of the furnaces.

Anaconda May Enter Bolivia

About a year ago one of the *Journal* contributors in Bolivia mentioned[1] that the Amalgamated Copper interests were investigating the copper mines of Corocoro, Bolivia, and now comes a cable from Paris announcing that the Anaconda Copper Mining Co. has been given an option on Corocoro United Copper Mines, Ltd., which controls about 1,450 acres in the Corocoro district. This company, though organized in Great Britain in 1909 with a capital of £700,000, is mainly French, its directors being: Baron René de Batz, A. Berthin, L. Charbonnel, G. T. Crane, J. L. Barber, Major H. M. Kersey, N. Berthin, E. F. Harrington, L. Monnier and Baron C. Portalis. The principal mines are the Vizcachani, Santa Rosa and Guallatiri.

The other leading interest at Corocoro is the Cia Corocoro de Bolivia, a Chilean company. Most of the Bolivian copper, amounting to 3,500 to 4,000 metric tons annually, is produced by these two companies. By the introduction of additional facilities, the output can be greatly increased. For over two hundred years, the Corocoro mines have been worked for native copper only. Recently the sulphates and sulphides have been mined and mills erected to treat these ores, though a considerable tonnage is high enough in copper to ship without milling. Corocoro is at an altitude of about 4,000 m. and is 339 km. from the port of Arica, Chile, with which it is connected by the new Arica-La Paz R.R.

[1] "Corocoro Copper District of Bolivia," by F. A. Sundt, "Eng. and Min. Journ.," Jan. 23, 1915.

Tin-Smelting Operations Begun at Perth Amboy

The reverberatory tin-smelting plant of the American Smelting and Refining Co. at Perth Amboy, N. J., was blown in this week, and the first crude tin was tapped on Mar. 7. As soon as a sufficient supply of crude tin has accumulated, the electrolytic refinery will be started—probably at the end of this week.

At present the operation is based on the importation from Bolivia of 750 tons of tin concentrates (60% Sn) per month. Some delay was experienced in starting the tin-smelting plant owing to the nonarrival of materials. The present supply of ore will last until about Apr. 1, before which time additional cargoes are expected. Gradually, as shipping conditions improve, the plant will be brought up to its capacity of 1,200 tons per month. Ultimately the plant may be much extended, for the United States consumption of tin is double Bolivia's output.

Chronology of Mining for February, 1916

Feb. 1—Wage increases granted by United States Steel Corporation and the mines of the Park City, Tintic and Bingham districts of Utah, and also on the Mesabi Range, became effective.—Kennecott Copper Corporation declared initial dividend.

Feb. 3—Electrolytic copper price, 25½c., exceeding all previous records.

Feb. 5—Midvale Steel and Ordnance Co. acquired control of Cambria Steel Co. at $81 a share.

Feb. 9—Cerro de Pasco Copper Corporation declared initial dividend.—Anaconda purchased property of Butte-Alex Scott Copper Co.

Feb. 14—Fire at Pennsylvania mine of Anaconda company resulted in death of 21 men.

Feb. 16—Dredge No. 5 of Marysville Dredging Co. launched at Marigold, Calif.

Feb. 18—Announcement of purchase of Pennsylvania Steel Co. by Bethlehem Steel Corporation.

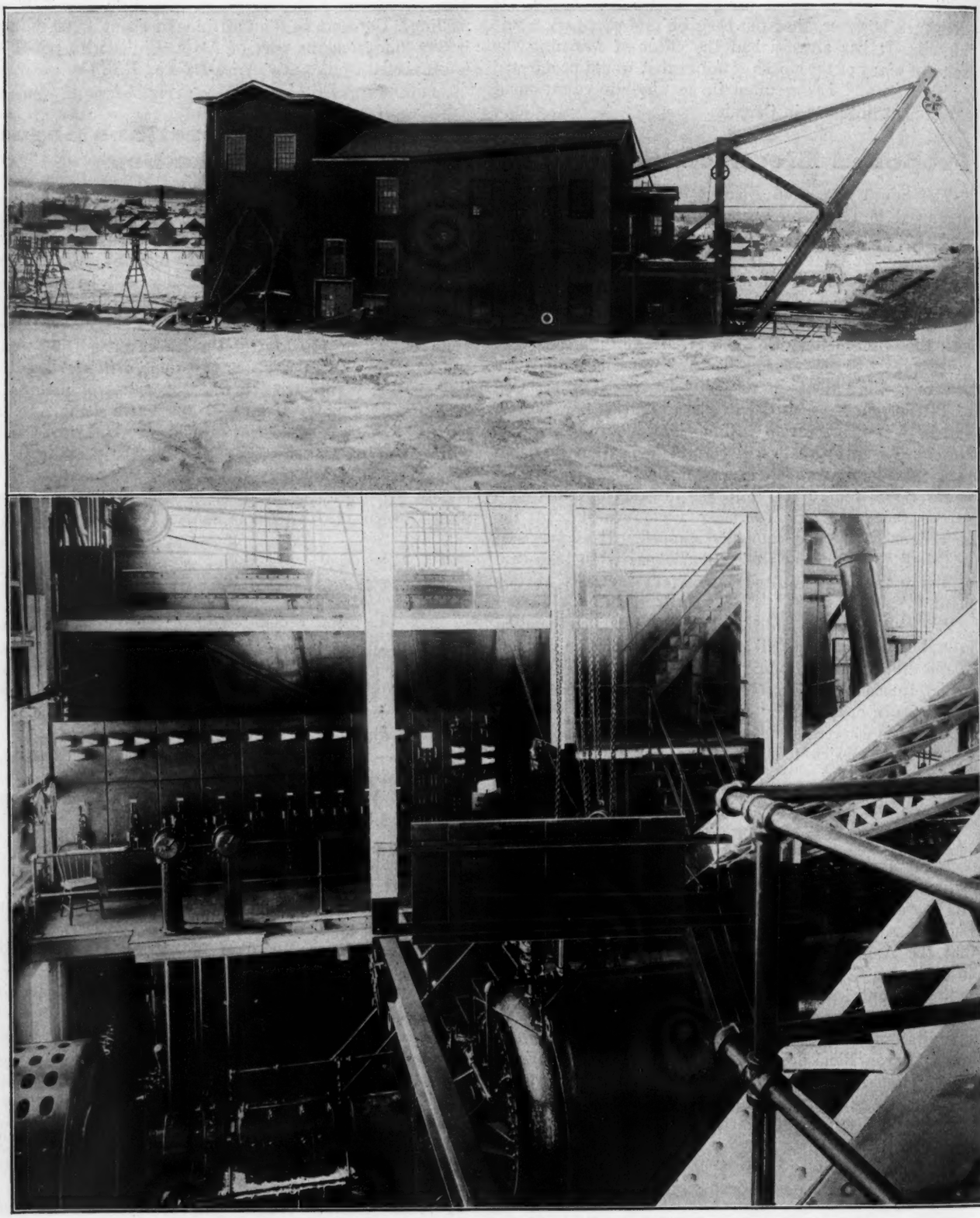
Feb. 21—Supreme Court of the United States upheld tax on income of mining companies, not allowing for exhaustion of ore reserves.

Feb. 26—Strike at American Brass Co., Ansonia, Conn., settled, after duration of 10 days. Strike of lead and zinc smelters at Leadville and Pueblo, Colo.

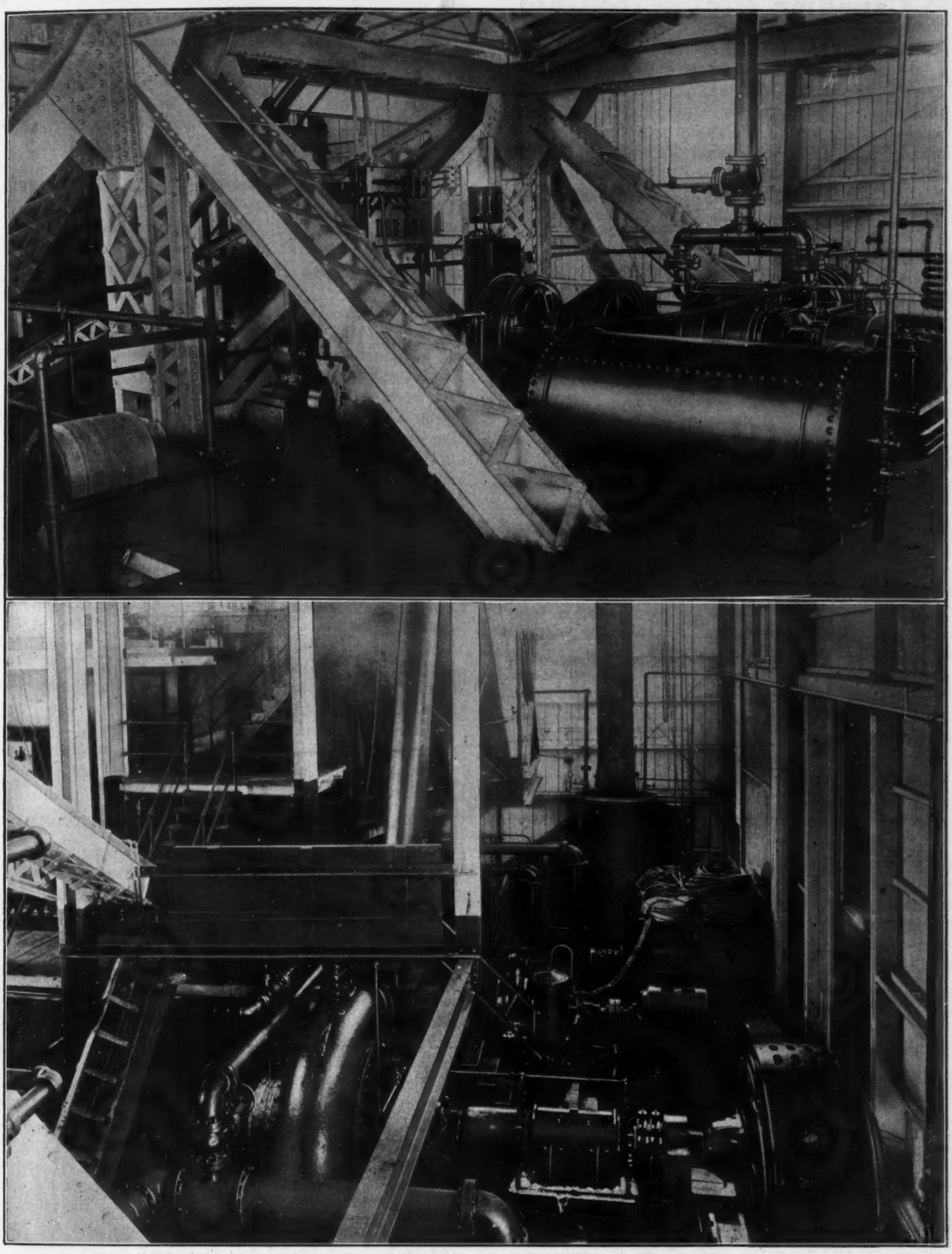
Feb. 28—Colorado lead and zinc smelters returned to work.

Feb. 29—Calumet & Arizona and Wolverine increased dividends.

Photographs from the Field



TAILINGS-RECLAIMING DREDGE OF THE CALUMET & HECLA CO. AT LAKE LINDEN, MICH.



INTERIOR OF THE CALUMET & HECLA TAILINGS-RECLAIMING DREDGE AT LAKE LINDEN, MICH

The dredge has been installed to recover tailings from the dump, the object being to give them a leaching treatment to recover additional copper. The equipment includes centrifugal sand pumps and all auxiliary machinery. Everything is electrically driven, while the hull is of steel construction.

Canadian Mining Institute

EDITORIAL CORRESPONDENCE

The 18th annual meeting of the Canadian Mining Institute was held at Ottawa, Ont., on Mar. 1, 2 and 3, 1916, headquarters having been arranged at the Chateau Laurier, where all the official and technical sessions were held, in addition to the annual dinner. The attendance was large, considering the conditions obtaining in the Dominion at present, and an exceptional amount of interest was manifested, particularly on questions of current importance.

The first session, on the morning of Mar. 1, was occupied by the routine business of the Institute, particularly the election of officers and council. As president, Arthur A. Cole, mining engineer for the Temiskaming & Northern Ontario Railroad Commission, was elected. The question of whether the Institute should apply for a Royal charter brought out an unexpected amount of discussion, so much that the remaining time at the disposal of the session was entirely consumed by it. Most of the members seemed to be opposed to the plan, and it was rejected.

Technical sessions followed, one being held each morning, afternoon and evening, with the exception that the annual dinner of the Institute replaced the Thursday evening session. An interesting and important paper was read by D. F. H. Sexton, of Halifax, N. S., on "The Employment of Returned Soldiers," in which the measures taken by the governments of Germany, France, Belgium and Great Britain to rehabilitate wounded or maimed men and enable them to take a self-supporting and dignified place in social life was discussed. The bad results of the bald pension system, such as is in effect in the United States, was clearly pointed out, showing that it leads inevitably to an idle or dependent life, totally devoid of the necessary features required by an effective utilization of whatever faculties may remain. By the systems now in practice the men are returned, as far as possible, to the localities, environment and occupation from which they were taken, and if the disablement prevents that employment, the men are trained to some task that they can perform.

At the Wednesday evening session a paper was read by Dr. Adam Shortt, of Ottawa, on "Canadian Gold and War Finance," in which it was maintained that the production of war necessities was of more value to the nation than gold production. A paper of much interest was read by H. W. DuBois, of Philadelphia, on the subject of "Copper Mining in Alaska," in which a great deal of information about the high-grade mines Bonanza and Jumbo was brought out. The lecture was accompanied by a large number of highly interesting colored lantern slides.

The Thursday morning session was largely occupied by the subject of flotation, an abstract of the paper on that subject by T. A. Rickard being read by Doctor Haultain, followed by discussion by G. D. Van Arsdale, of New York, and H. W. DuBois. The latter also read a paper on "The Flotation of Bornite." The scheduled papers by Henry E. Wood, of Denver, and E. P. Mathewson, of Anaconda, were not read, in the absence of their authors, but will be printed in the bulletin.

One of the subjects that elicited a great deal of earnest discussion was the proposal of the Minister of Finance of the Dominion to levy a retroactive tax upon the mining industry.[1] The actual terms of this tax had not been definitely set forth, but the suggestions seemed so oppressive that the Institute considered itself in duty bound to protest. A committee was appointed to confer with the Minister of Finance and try to show him that the basis of the tax was inequitable and that one company, under the proposed terms, would have to pay a tax of a million and a quarter dollars.

Among the other papers read were the following: "The Carbonization and Briquetting of the Saskatchewan Lignites," by S. M. Darling; "The Coal Situation in Canada," by W. J. Dick; "The Discovery of Phosphate of Lime in the Rocky Mountains," by Dr. F. D. Adams; "Some Effects of the War on Canadian Mining Industries," by Dr. Alfred Stansfield; "The Magnesite Industry in Canada," by Howells Frechette; "Some Conditions Affecting Education in Mining and Metallurgy," by Prof. J. C. Gwillim; "Mining Education," by L. D. Burling; "Methods of Construction of Deep Mine Shafts in Water-Bearing Material," by J. W. Doty; "Rock-Crushing Tests at McGill University," by Prof. J. W. Bell.

The annual dinner proved to be an extremely inspiring one, largely attended. President Cole introduced the speakers, who were Representatives Thompson, of Yukon Territory and MacDonald, of Nova Scotia; Bradley Stoughton, of New York, representing the American Institute of Mining Engineers; H. W. DuBois, of Philadelphia, representing the Mining and Metallurgical Society of America; and Dr. F. D. Adams, of Montreal, a past-president of the Institute. The officers of the Institute are to be congratulated upon the magnificent spirit of the meeting, and the secretary, H. Mortimer-Lamb, is to to be particularly commended for the successful results attending his labors.

Some of the members visited the Royal Mint, by courtesy of Dr. J. Bonar, deputy master, while another party visited the laboratories of the Mines Department.

The Miner in the Trenches

It must be a novel and extraordinary experience to carry on underground warfare, says the *Cornish Post and Mining News*. The mining engineer who is engaged in destructive mining at the front commands a large body of human moles, who dig as silently as possible until their galleries are underneath the trenches of the enemy. All the time they know that a similar body of miners is working toward their own trenches and emplacements. Sometimes each can hear the sound of the other's tools, or one lot can tell that the other is dragging a heavy load through the hidden gallery.

It requires the highest kind of sustained courage to remain at a listening post in a narrow tunnel day and night knowing that your enemy is gradually getting nearer, and that you may be blown up. Military mining calls for the finest types of tunneling men and for leadership of a high order. Science, initiative, endurance and sustained courage are called for, and when the story of the tunneling corps in Belgium, France and Gallipoli can be told, the public will be amazed at the ingenuity, the fortitude and the efficiency of the colliers, tin miners and their intrepid leaders.

[1] Commented on editorially in the "Journal," Mar. 4, and in Editorial Correspondence and elsewhere in this issue.

Editorials

Doctor Foster's Bill

The Congress of the United States is unfortunately so constituted that it is averse to benefiting from expert advice. Not only that, but it glories in relegating the experts to the background. If it be a question of an army or navy program, the military men must have nothing to do with it. If it be a question of developing a new banking system, the bankers of the country are the last persons in the world to be consulted, but rather is the advice of butchers and bakers and farmers and lawyers to be sought and followed. It is not surprising, therefore, that there should be a similar attitude with regard to mining matters. When a business concern finds it necessary to consider a new matter of policy, it commonly gets an expert or a committee of experts to study the question and report. Not so when Congress has to do something. Its members are ready for anything and everything. They consider that they were sent to Washington to be so.

Now, the Committee on Mines and Mining of the House of Representatives was unwilling to consent to a commission to study the laws of the United States relating to the location of mining claims on the public domains with a view to the reform thereof, but it recognizes that there has been so much agitation of this matter that something ought to be done about it. The mining engineers and mining operators of the country have said through their spokesmen that they do not know yet how to draft a new law that will be generally satisfactory. That made no impression upon Doctor Foster, the chairman of the committee, who says, in effect, that if the mining men can't draft such a law, he can, and proceeds to do so in the form of a bill that was introduced in the House of Representatives on Feb. 25, 1916, under the number H. R. 12,275.

Doctor Foster's bill is 65 pages long, and it will take a long time to scan it carefully. However, the main provisions respecting the location of mineral claims may be immediately put before the public in simple language.

In the absence of an outcrop or surface indications, a temporary location of 1,500x600 ft. may be made. Exploration work must be begun within 60 days and then must be prosecuted with reasonable diligence, but if no discovery be made within a year from the time of location, the claim lapses.

If a discovery be made, within 30 days thereafter the lines of the claim must be swung so as to coincide with the strike of the vein, the width of the claim to be 300 ft. on each side. The locator then has the right to all mineral deposits within the vertical projection downward of his lines, except that if he should happen to find a valuable placer deposit, something different would happen.

When a vein outcrops and no temporary location for discovery purpose is necessary, a claim of 1,500x600 ft. may be located, and the locator shall have the right to everything within the vertical projection downward of his lines, and in addition thereto, shall have the right to follow *outside of his side lines* the vein on which the location was made; any right thereto that might be advanced by the owner of a claim on the dip side being headed off by some provisions in Section 2322-b that may be unraveled by a Philadelphia lawyer.

Mining claims containing "veins or lodes of quartz or other rock in place bearing valuable mineral deposits" may be laid out in the form of a square with sides 2,100 ft. Apparently it is not necessary for anybody to know that there be "veins or lodes of quartz or other rock in place bearing valuable mineral deposits," for 30 days is allowed for the beginning of explorations and one year for the making of a discovery. Having made a discovery, the claim must be swung so the length of 2,100 ft. will run along the strike. The width (2,100 ft.) may be taken wholly on the dip side. The owner of such a claim is then to have everything within the vertical projection downward of his lines, except that if some other fellow has made a 1,500x600-ft. location on a known vein, the extralateral rights of the prior location prevail. If you cannot anywhere get a 2,100x2,100-ft. square location, you may take what the other fellows have left, no matter if your lines be irregular.

Between the 1,500x600-ft. and the 2,100x2,100-ft. locations we should take the latter every time. However, the ideal way to our mind would be to find a vein and take three 1,500x600-ft. locations, and then locate a couple of 2,100x2,100-ft. claims adjoining on the dip side. By a judicious adjustment of our temporary lines, while we were finding the strike of the vein, we should keep all interlopers out of the district for a long time. If there weren't any strike we'd arm our men with machine guns and prepare to hold out against all comers. Intelligent reader, is there any use in going further in discussion of this folderol? We believe that we are on record as having said: "Give us a revision of the existing mining law. You may not give us the best, but you cannot give us anything that will not be an improvement on what we have." We take that all back. As between the existing law and Doctor Foster's proposal, we think that the former, bad as it is, would better be let alone.

London Standard Copper

Our editorial of last week on the subject of standard copper in the London market was almost prophetic. In this we called attention to the insignificance of the transactions in this class of copper and remarked that they were gradually ceasing to attract attention on this side of the ocean. This was on Mar. 1. On Mar. 2 the British government instituted an order that "it shall be unlawful for any person to sell or buy, or to offer to sell or buy, the following: Iron, steel, copper, zinc, brass, antimony, nickel, tungsten, molybdenum, ferroalloy, or any other metal specified by the Ministry of Munitions as necessary for the production of any war material unless the metal is in the possession of the seller or in course of

production for it; and in the case of the buyer, unless the purchase is made for the actual consumers."

The effect of this order was immediately to suspend operations on the London Metal Exchange. However, there was a resumption on Mar. 6, this having been permitted with certain restrictions by the government. It is apparently the desire of the British government to eliminate the influence of speculation in essential commodities. Such a policy will of course not only be of no effect upon American producers, but also will be approved by them. They would similarly like to eliminate speculation here and let the transactions in the metals be confined to direct negotiations between producers and consumers, as indeed they are in the main.

The primary copper market of the world has long been in New York, where the sales of about 70% of the world's production originate. The London market for standard copper has been subordinate and in recent years has been of interest only for its sentimental effect. In the main it had to keep in tune with the prime market, for if it ranged below parity refiners would clean it up, while if it ranged above parity, they would sell contracts and deliver electrolytic copper against them, which would promptly bring it down. Since the war, however, such natural actions have been prevented by government restrictions upon trade.

In former years the price for standard in the London market was the basis of settlement for raw material in many parts of the world, but that custom also has been disappearing. Within the last year or two it has become the custom in Chile to settle on the New York rather than the London price. The only reversion in that respect has been in the case of Australia, where lately the government has been interfering and through the newly formed Australian metal exchange prescribed London standard once more as the basis.

Tin Smelting in United States

The inception of tin smelting at the Perth Amboy plant of the American Smelting and Refining Co., this week, is a matter of general commercial importance as well as of metallurgical interest. It is of commercial importance because up to the present Bolivia's export trade with this country has been practically nil, though the United States is the world's largest consumer of the metal principally produced by Bolivia. The tin output of Bolivia is about 25,000 metric tons per annum; the United States consumes over 50,000 tons. The smelting of Bolivian concentrates here is therefore a logical industrial development accelerated by conditions arising out of the European War and the resultant closer commercial relations between the Americas.

With the establishment of a tin-smelting industry in the United States, the Bolivians will in the course of a short time be provided with dollar exchange and will thus have the most convenient means for purchasing in the United States. "Trade follows the flag" in some parts of the world, but on the west coast of South America trade follows the miner and smelter—a fact that should not be overlooked by our manufacturers who are looking to South America for extension of their trade.

The American Smelting and Refining Co. has contracted initially for 750 tons of Bolivian tin concentrates per month, and the new tin-smelting plant at Perth Amboy, N. J., produced its first crude tin on Mar. 7. While this is a small beginning it is not like some previous abortive attempts to initiate tin smelting in this country. The ore supply for the present operation is definitely contracted, and no discriminating duties are to be levied by Bolivia. The American Smelting and Refining Co. is in a position to tide over the initial operating difficulties that so often kill new enterprises.

That the tin-smelting industry in this country is destined to grow seems certain. The American Smelting and Refining Co. has at its command all the financial resources and technical skill that may be required to take care of any contingencies that arise, and since the United States is the greatest user of tin among the nations, American tin smelters are assured a good market, with some advantages over European smelters in the matter of freights—and perhaps in the matter of traditions. The Perth Amboy plant will refine its crude tin electrolytically.

Flotation Concentrates

In the *Journal* of Jan. 9, 1915, we stated that we thought it reasonably safe to say that nearly one million tons of ore—copper, zinc, lead, etc.—was treated in North America in 1914 by the flotation process, the production of concentrates therefrom being without any doubt upward of 150,000 tons. It was impossible to make much headway with a similar statistical investigation for 1915 that was inaugurated, but there is evidence that leads to the belief that the quantity of ore treated by this process in that year was upward of 3,000,000 tons. It will be very much greater in 1916, for the Anaconda and Inspiration companies—the two great concerns—scarcely more than began operations in 1915.

The production of floated blende concentrates in 1914 was nearly 100,000 tons. In 1915 it was in the neighborhood of 250,000 tons. About 100,000 tons of American spelter, not counting any derived from Australian material, was obtained from floated concentrates in 1915. In this connection let it be noted that the mills employing the flotation process produce a large proportion of jig and table concentrates as well as the floated froth. A year ago it was remarked that the production of floated concentrates was without doubt destined to increase materially during the next year or two. The prophecy has not only been verified, but also we regard it safe to repeat it.

Mining Men for Congress

The Committee on Mines and Mining of the House of Representatives consists of members from states east of the Mississippi River with the exception of Mr. Taylor, of Colorado. There is not a mining man among them—not even Mr. Taylor, although he is in sympathy with the industry and is an intelligent, useful representative.

But is it not sad that the great states of Arizona, Utah, Idaho, Montana and others, wherein mining is the great industry, the predominant industry, do not select men from that industry to represent them in Congress? If they did so, such men would probably obtain appointments to the Committee on Mines and Mining and the needs of the industry west of the Rocky Mountains would receive intelligent consideration. Republican, Democrat or Progressive, it matters not. Let the people of those states nominate mining men.

BY THE WAY

A Chink who was running a restaurant in Morenci when Morenci was very young became sufficiently Americanized and uptodate to provide meal tickets for the use of his patrons. These tickets bore this vital injunction: "Lose 'em ticket, no catchem mealee."

⁂

J. Grant Lyman, one of our most versatile mining-stock promoters, has been rudely interrupted in the pursuit of pleasure on his newly acquired yacht in Florida waters by the United States Secret Service men and others. His latest harvest in sucker finance was made under the firm name of J. H. Putnam & Co., Broad St., New York.

⁂

At the Tramway mine of the Anaconda Copper Mining Co., Butte, Mont., the best record of ore hoisted for two successive 8-hr. shifts is 3,130 tons distributed equally between the two shifts. The actual hoisting time was seven hr. on each shift. The average depth from which this tonnage was hoisted was 1,700 ft. Skips, each holding 4.5 tons, were used in the two hoisting-compartment shaft, each compartment being 4x5 ft. The shaft is also used for men and supplies. There was no thought at the time of making a record hoist. The mine superintendent (George E. Moulthrop) was simply trying to get rid of an accumulation of broken ore. However, it stands as the best performance for this mine and is believed also to be the best for Butte.

⁂

Why is it that novelists are so unable to write good mining stories? We mean stories that not only have intrinsic interest, but also are convincing as to knowledge of technical conditions portrayed, as are Kipling's stories in other lines. We are always on the lookout for mining stories, hoping that some day we shall find the real thing. The latest is "The Man from the Bitter Roots," by Caroline Lockhart (J. B. Lippincott Co.), a Montana placer-mining story. It began well and we were exhilarated with a newborn hope, but alas! it fizzled early and from our standpoint became humorous. The author was unusually venturesome in incorporating an engineer's report in detail, which was about the most humorous thing of all. However, Caroline Lockhart has considerable skill, and if in her next attempt she would consult a mining engineer, she might do something worth while.

⁂

The formation of the firm of Guggenheim Bros. was announced in New York on Mar. 7. The firm will be composed of Daniel, Isaac, Simon, S. R. and Morris Guggenheim, who formerly made up the firm of M. Guggenheim's Sons, and Harry F. and Edmond A. Guggenheim and William C. Potter. Harry F. and Edmond A. Guggenheim have been schooled for a number of years in connection with important metallurgical and mining enterprises. Harry F. is the son of Daniel Guggenheim. He has had several years of experience in the plants of the American Smelting and Refining Co. in Mexico. Edmond A. is the son of Morris Guggenheim. He has spent some time in the refineries of the American company. William C. Potter has been first vice-president of the Guaranty Trust Co. for the last four years. For some time previous to that he was an executive and operating officer of the Guggenheim Exploration Co. and the American Smelting and Refining Co. It is understood that he will remain on the executive committee of the Guaranty company and also on the board.

⁂

The Stockholder Has a Fat Chance

When asked when he would issue an annual statement for 1915, the following conversation ensued between the general manager of a well-known mining company and a reporter in one of our Western mining centers:

We're not going to issue one. We'll get up a report for the directors, and that's all.

But how about your stockholders?

If they want the information, they can come and ask.

And how about the public; it would like to know how the ——— is making it.

Damn the public; it's none of their business.

If you were in Nevada, where the law requires every company to publish statements once or twice a year, it would be different with you, wouldn't it?

Probably; but we are not. Anyway, all this publishing of these statements is an unnecessary expense.

But are not only your stockholders but the public entitled to such information?

Not on your life.

But how about your stockholders who live a thousand miles away; will you require them to make a special trip to the mine office to peep for a moment into your ledger, when with a statement you might save them this time, trouble and expense?

Let 'em move another thousand miles away; that's their lookout, not ours; good day.

Shares in this particular company are scattered not only throughout the state in which the mine is situated, but from Dan to Beersheba over the United States.

⁂

The *Evening Post* thus describes how a matter of legislation of the first order of importance to the mining industry was considered in the House of Representatives, incidentally remarking that the idea that freedom of debate is no longer to be found in that body fails to take one practice into account. The other day the House had resolved itself into "a committee of the whole house on the state of the Union for the further consideration of the bill, H. R. 406," the coal and oil leasing bill. The clerk read the measure by title, and the "further consideration" began. Representative Harrison, of Mississippi, opened the discussion, having 40 min. for his speech, and made a strong argument on the subject of exports of munitions. Representative Slayden followed with remarks on the Mexican situation. Mr. Quezon, the Philippine delegate, then replied to what he regarded as aspersions upon him by a member of the House in connection with the campaign for Philippine independence, and this matter was really debated by as many as three or four speakers. The discussion of the coal and oil leasing bill having progressed in this way for 1 hr. 44 min., Representative Mays, of Utah, tried to sidetrack it by using up 15 min. in talking about coal and oil leasing. He was properly if quietly rebuked by the next speaker, Representative Helgeson, of North Dakota, who, with an hour before him, recalled the attention of the House to the subject before it by assailing Peary's claims to honors in exploring, and by our own Representative Bennet, who took up the phase of coal and oil leasing so prominent now—waterway legislation needed for New York harbor. This ended the time, three hours, allotted to general debate on the bill, the *Congressional Record* having been enriched to the extent of 32 columns.

PERSONALS

Albert G. Wolf examined mining property in Gilpin County recently.

Sutro Brothers & Co. have removed their offices to the Equitable Building, No. 120 Broadway, New York.

R. R. Leslie, manager of Butters Divisadero Co., Divisadero, Salvador, is expected to be in San Francisco early in March.

B. T. Colley, smelting superintendent for the Braden Copper Co., sailed on Mar. 4 for Chile after a vacation in the United States.

W. H. Wright, of the Malm-Wolf Co., Denver, has been engaged by the Research Department of the Colorado School of Mines.

John Kirchen, general manager of the Tonopah Extension Mining Co,. has been elected president of the Nevada Mine Operators' Association.

Samuel P. Sadtler & Co., consulting and analytical chemists, have removed their office and laboratory to 210 South Thirteenth St., Philadelphia.

Dr. Henry M. Payne, mining engineer, has returned to New York after a long sojourn in Siberia and Russia, where he was engaged in professional work.

Pope Yeatman gave a dinner at Delmonico's in New York on Mar. 2, in honor of Fred Hellman, general manager of the Chile Copper Co., who is visiting New York.

F. W. Pugsley, metallurgical engineer with McKinley-Darragh mines, Cobalt, Ont., has turned his new matte-forming explosive "Rochamboite" over to the French Government.

Thomas M. Skinner, Jr., has accepted the superintendency of the Mid-Continent Chemical Co. and is erecting a new plant to manufacture caustic soda, sulphuric acid and silicate of soda.

Alfred W. Dodd, who has been for many years assistant sales agent of the New Jersey Zinc Co., has become Eastern sales agent for the Granby Mining and Smelting Co. of St. Louis.

S. S. Rodgers has been appointed superintendent of the zinc concentrator at Anaconda, Mont. L. McDonnell, R. W. Handley and T. W. Hayes have been appointed foremen of the zinc concentrator.

George A. Camphuis, of the firm of Camphuis & Rives, El Paso, is developing copper properties for Eastern interests in Pima County, Arizona, with present address P. O. Box 396, Tucson, Arizona.

Edwin S. Slick, who has been general manager and a vice-president of the Cambria Steel Co., will continue in that capacity under control of the company by the Midvale Steel and Ordnance Co.

Nelson Dickerman has resigned as general manager of the Pato Mines (Colombia), Ltd., and the Nechi Mines (Colombia), Ltd., and will return from Colombia to San Francisco the latter part of April. W. A. Prichard has been appointed as his successor.

Rush M. Hess has returned from Ecuador where he has been mine superintendent for the South American Development Co. for a number of years. He expects to remain for a period in the United States, his present address being 325 Franklin St., Plainfield, N. J.

Donald M. Liddell, for several years managing editor of the "Journal," has resigned and is now consulting engineer with Merrill, Lynch & Co., No. 7 Wall St., New York. Percy E. Barbour, for some time on the staff, succeeds Mr. Liddell as managing editor. R. L. Herrick has joined the staff of the "Journal."

Edwin Higgins, chief mine inspector for California, returned to San Francisco from a professional visit to mines on the Mother Lode, reports that he found the attitude of the operators coöperative. Two safety stations will be established in the Mother Lode district, one at Jamestown and one at Sutter Creek, fully equipped for rescue work.

John Herschel East, Jr., of the U. S. Bureau of Mines, will have charge of the safety work in the Mammoth Copper Co. mines at Kennett, Calif. This is the first appointment from the Bureau by California mine operators. Mr. East has been with the Bureau car in Michigan. There are 600 underground men at the Mammoth and about 900 surface men and smelters.

The managing geologists of the Associated Geological Engineers announce the opening of a New York office at 3112 Equitable Building, 120 Broadway, in charge of Frederick G. Clapp, managing geologist of the petroleum division. They will continue the practice of geological engineering in all its branches, with special reference to examinations and reports on oil and gas properties.

H. J. Stander, who is doing flotation experimental work for the College of Mines and for the Arizona State Bureau of Mines, has been called to Brunswick, Ga., for consultation work with the Yaryan Oil and Rosin Co. of that city. Mr. Stander has been making an especial study of oils, with a view to determining the relations of the oils and the oil mixture to the minerals contained in the ore.

W. T. Burns has been promoted to be superintendent of electrolytic refineries of the Anaconda Copper Co. at Great Falls, Mont., and will have charge of the electrolytic copper refinery and the electrolytic zinc plant, which is in process of construction. E. E. Brownson, formerly chief chemist, has been promoted to be assistant superintendent of the electrolytic copper refinery. Dan Tracy has been promoted to be superintendent of the furnace refinery. Pat Cuddihy has been promoted to be shop foreman of the furnace refinery.

J. J. Carrigan, formerly safety engineer for the Butte mines of the Anaconda Copper Co., has been promoted to be assistant superintendent of mines and will have charge of all mines in the newly created zinc group. R. S. Foster, who formerly acted as assistant to Mr. Carrigan, has been promoted to be safety engineer for the Butte mines. W. C. Douglass, formerly shift boss at the Badger State mine and in charge of the work done at the Moose shaft, has been promoted to be assistant safety engineer for the Butte mines.

S. R. Elliott, superintendent of the mines of the Negaunee district for the Cleveland-Cliffs Iron Co. since 1904, has been advanced to general superintendent, a position just created. His headquarters will be in Ishpeming, Mich., where the company has its main offices. His successor at Negaunee has not been named. He will look after a great deal of the work that was formerly done by M. M. Duncan, whose title has been changed from agent to general manager. A. J. Yungbluth, assistant auditor of the company, has been made purchasing agent for the entire company. C. J. Shaddick, paymaster, becomes the assistant auditor and H. L. Ramsdell takes the paymaster position. The changes were announced Mar. 1 by W. G. Mather, president of the company, who was in Ishpeming on that date. The Cleveland-Cliffs company now has over 20 mines in the Lake Superior district and more are to be opened.

OBITUARY

Alfred D. Waterman, for the last 25 years connected with the Illinois Steel Co. and the United States Steel Corporation, died on his way to California, Feb. 22, aged 67 years. Since 1901 he has been a member of the staff of W. R. Walker, assistant to the president of the Steel Corporation.

James T. Treadwell died suddenly at Oakland, Calif., Mar. 6, aged 66 years. He was born at St. Andrews, N. B., and went to California while a young man, and engaged in mining there. He was one of the early explorers of Alaska and was one of the party which located the gold deposits on Douglas Island, where the Alaska Treadwell and other mines are now operated.

SOCIETIES

The Montana Society of Engineers has issued the first number of a quarterly which is to be printed regularly hereafter. The Montana society was organized in Helena July 5, 1887, with 48 charter members. Joseph T. Dodge, of Helena, was the first president. Among those who have since filled that position are Elliott H. Wilson, Charles W. Goodale, Eugene Carroll, Joseph H. Harper, B. H. Dunshee, Charles H. Bowman, R. A. McArthur, and Reno H. Sales, of Butte. Clinton H. Moore has been secretary for 13 years past.

American Institute of Mining Engineers—The Utah section held its semiannual meeting Mar. 7. By courtesy of the Utah Copper Co. and the Garfield Smelting Co. arrangements were made to visit the plants of these companies, the afternoon being spent at the Arthur mill and Garfield smeltery. In the evening there was a dinner for the members at the Alta Club, after which letters and papers received in regard to the part the Institute will take with reference to military preparedness were discussed. Following this, a paper was read by R. F. Barker on "Preparation of Powdered Coal for Reverberatory Smelting at Garfield."

INDUSTRIAL NEWS

The Hardinge Conical Mill Co. has moved its offices to the Equitable Building, No. 120 Broadway, New York.

The General Smelting Co., has removed to Stock Exchange Bldg., Broad and Walnut Sts., Philadelphia, Penn.

The Ohio Brass Co. has removed its New York office to 1822 Cortlandt Bldg., 30 Church St., New York City.

The American Coal Products Co. has merged with its subsidiary, as the Barrett Co. All departments of the business will be carried on as heretofore.

Sill & Sill has purchased the business of the Parks Electro-Cyanide Co. and will test for and install this process as well as carry on a general ore-testing business and make umpire assays. The laboratory is at 1602-1604 Cosmos St., Los Angeles, Calif.

Among recent orders received for Myers-Whaley shoveling machines have been two No. 4 machines for the Retsof mines, New York State; one for the Atlas Portland Cement Co., in Missouri; one for the Marquette Cement Mfg. Co., in Illinois; one for the Section 30 Mining Co., at Duluth, Minn.; and one from Messrs. Mason & Barry, Ltd., Mina de S. Domingos, Portugal. Business is reported active.

The Traylor Engineering and Manufacturing Co., of Allentown, Penn., has taken orders for the following tube and ball mills: Eden Mining Co., Nicaragua, one 6x5-ft. ball mill and one 5x10-ft. tube mill; Pennsylvania Feldspar Co., two 6-ft. 6-in. by 18-ft. tube mills; 4-ft. 6-in. by 3-ft. ball mills to the Goldschmidt Thermit Co., Henry E. Wood Ore Testing Co. and to the National Carbon Co.; Hercules Mining Co., one 7x6-ft. tube mill; Brooklyn Mining Co., complete concentrating plant including 6x8-ft. tube mill, concentrators, flotation cells, etc.; Consolidated Mining and Smelting Co. of Canada, Ltd., two 5x18-ft. mills; L. Vogelstein & Co., one 6x8-ft. tube mill; Empire Copper Co., one 6x6-ft. ball mill.

TRADE CATALOGS

Joseph Dixon Crucible Co., Jersey City, N. J. Booklet, Graphite Products. Illustrated, 24 pp., 3½x6 in.

Trussed Concrete Steel Co., Youngstown, Ohio. Catalog. Portable Steel Buildings. Illustrated, 32 pp., 8½x11 in.

Lidgerwood Mfg. Co., 96 Liberty St., New York. Bulletin No. 15. Electric mine hoists. Illustrated, 30 pp., 9x12 in.

Lane Mill and Machinery Co., Los Angeles, Calif. Catalog No. 8. Slow speed Chilean mills. Illustrated, 52 pp., 6x9 in.

The Alexander Milburn Co., 1420-26 W. Baltimore St., Baltimore, Md. Catalog. Portable acetylene lights. Illustrated, 52 pp., 6x9 in.

Link-Belt Co., Philadelphia, Penn. Book No. 249. Insuring the Coal Supply. Illustrated, 24 pp., 6x9 in. Book No. 250. Wagon and Truck Loaders. Illustrated, 62 pp., 6x9 in.

A. S. Cameron Steam Pump Works, 11 Brodaway, New York. Bulletin No. 110. Duplex pumps. Illustrated, 36 pp., 6x9 in. Bulletin No. 154. Centrifugal pumps. Illustrated, 16 pp., 6x9 in.

The Austern-Western Road Machinery Co., Chicago, Ill. Pamphlet. "The Road Builder's Guide To a Complete Grading, Rock Crushing and Road Surfacing Equipment." Illustrated, 80 pp., 7x10 in.

D. J. Kelsey, 51 Elm St., New Haven, Conn. Circular. Tilting drafting table with lifting swing blade attachment. Illustrated. Circular. Draftsman's universal square and protractor, combination angle and scale. Illustrated.

Roy C. McKenna, president of the Vanadium-Alloys Steel Co., Pittsburgh, Penn., has written an interesting article on "Tungsten Mining in Colorado." A free copy of this article can be obtained by writing to the Vanadium-Alloys Steel Co., Pittsburgh, Penn.

The Webster Manufacturing Co., Tiffin, Ohio, has just published Catalog No. 42, describing the various details of the machinery which it manufactures for the handling of materials and products, including conveying, elevating, screening, crushing, washing, storage, and power transmission equipment. The catalog has 520 pages and is beautifully bound in gray buckram. It is one of those invaluable books to the engineer designing large construction wherein such equipment is required, and to these the company will be glad to send copies of this catalog on application.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

AIR—Method for Dehumidifying and Cooling Air. Willis H. Carrier, Buffalo, N. Y., assignor to Buffalo Forge Co., Buffalo, N. Y. (U. S. No. 1,172,429; Feb. 22, 1916.)

AIR BLAST—Apparatus for Applying Air Blast to Ingots. Robert Abbott Hadfield, Westminster, England. (U. S. No. 1,172,279; Feb. 22, 1916.)

ALLOY—Precious-Metal Alloy of Platinum, Palladium and Gold. Rudolph John Peschko, York, Penn. (U. S. No. 1,169,753; Jan. 25, 1916.)

ALUMINUM—Process of Manufacture of Pure Aluminum. E. Martin, Marseilles, France. (Brit. No. 9,662 of 1915.)

AMALGAMATOR—Pan-Motion Amalgamator. Karl Senn, Alameda, Calif. (U. S. No. 1,172,171; Feb. 15, 1916.)

CASTING—Means for Casting Metals, Including Their Alloys. Charles Vickers, Niagara Falls, N. Y., assignor to the Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,172,506; Feb. 22, 1916.)

CRUSHING—Grinding Mill. David Cole, Tucson, Ariz. (U. S. No. 1,172,673; Feb. 22, 1916.)

DRILL—Fluid-Operated Drill. Caid H. Peck, Athens, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,172,901; Feb. 22, 1916.)

DRILLING—Swelled Coupling and Bit Used in Diamond Drilling. Nathaniel Edward Jenkins, Goldfield, Nev., assignor of one-half to William J. Mitchell, Spokane, Wash. (U. S. No. 1,172,139; Feb. 15, 1916.)

DRILLS—Device for Removing Stuck Drills. Robert Clyde Cameron, Goldfield, Nev. (U. S. No. 1,171,317; Feb. 8, 1916.)

ELECTRIC FURNACE. Process and Apparatus for the Electric Firing of Materials and Ores. William H. Hampton, New York, N. Y., assignor to the Conley Electric Furnace Co., Inc., Wilmington, Del. (U. S. No. 1,171,117; Feb. 8, 1916.)

FELDSPATHIC AND PHOSPHATE ROCK, Combined Process of Treating. Harry P. Bassett, Catonsville, Md., assignor to the Spar Chemical Co., Baltimore, Md. (U. S. No. 1,172,420; Feb. 22, 1916.)

FLOTATION—Improvements in the Separation of Mixed Metallic Sulphides. L. Bradford, Broken Hill, N. S. W., Australia. (Brit. No. 21,880 of 1914.)

FUEL—Apparatus for Feeding Pulverized Fuel. George W. Short, Sharon, Penn. (U. S. No. 1,172,745; Feb. 22, 1916.)

GAS WASHING—Method of and Apparatus for Gas Washing. Hermann A. Brassert and Charles J. Bacon, Chicago, Ill. (U. S. No. 1,172,930; Feb. 22, 1916.)

INGOTS—Process of and Apparatus for Forming Compound Ingots. John Slattery, Chrome, N. J. (U. S. No. 1,172,747; Feb. 22, 1916.)

IRON—Process of Producing Dephosphorized High-Grade Pig Iron. Paul L. T. Héroult, New York, N. Y. (U. S. No. 1,172,597; Feb. 22, 1916.)

LEAD ARSENATE—Manufacture of Lead Arsenate. John A. Schaeffer, Joplin, Mo., assignor to the Picher Lead Co., Joplin, Mo. (U. S. No. 1,172,741; Feb. 22, 1916.)

METALS—Method of Treating Metals to Alter Their Molecular Structure. Frederic L. Bishop, Pittsburgh, Penn. (U. S. No. 1,171,832; Feb. 15, 1916.)

SULPHIDES—Treating Metallic Sulphides, Etc. Utley Wedge, Ardmore, Penn. (U. S. No. 1,169,444; Jan. 25, 1916.)

SULPHUR—Process for the Recovering Elemental Sulphur From Sulphur Gases. William F. Lamoreaux, Isabella, Tenn. (U. S. No. 1,169,726; Jan. 25, 1916.)

SULPHURIC-ACID CHAMBERS, Improvements in or Relating to. J. Harris, Sheffield, and D. H. Thomas, Morriston, England. (Brit. No. 6,026 of 1915.)

TIN—Improvements in the Extraction of Tin from Ores. F. B. Dick, London, England. (Brit. No. 23,613 of 1914.)

TIN—Process of Detinning. Franz von Kügelgen, Holcombs Rock, Va., and George O. Seward, East Orange, N. J., assignors, by mesne assignments, to Columbua-Knickerbocker Trust Co., trustee. (U. S. Nos. 14,070 and 14,071—reissues; Feb. 15, 1916.)

TITANIC-OXIDE-CONCENTRATE PRODUCT and Method of Obtaining the Same. Auguste J. Rossi and Louis E. Barton, Niagara Falls, N. Y., assignors to The Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,171,542; Feb. 15, 1916.)

TITANIFEROUS ORES—A Process for the Direct Production of Refined Steel from Titaniferous Iron Ores. J. J. Loke and W. A. Loke, The Hague, Holland. (Brit. No. 5,618 of 1915.)

TUBE MILLS—Construction of Tube Mills and Linings Therefor. David Jack Nevill, Denver, Colo., assignor to the Stearns-Roger Manufacturing Co., Denver, Colo. (U. S. No. 1,169,276; Jan. 25, 1916.)

VENTILATION—Mine-Ventilating System. Frederick A. Hoskins, Dubuque, Iowa. (U. S. No. 1,171,340; Feb. 8, 1916.)

VOLATILIZATION—Process of Volatilizing Ores. Selden Irwin Clawson, Salt Lake City, Utah. (U. S. No. 1,169,530; Jan. 25, 1916.)

WATER—Purification of Water by Passing Through Blast Furnace Slag. Joseph C. Heckman, Avalon Borough, Penn. (U. S. No. 1,171,046; Feb. 8, 1916.)

ZINC—Process of Making Briquettes from Zinc Ores and Material Containing Zinc. Otto Kippe, Osnabrück, Germany, assignor to General Briquetting Co., New York, N. Y. (U. S. No. 1,168,401; Jan. 18, 1916.)

Editorial Correspondence

VALDEZ, ALASKA—Mar. 5

(By Telegraph)

Kennecott Miners demand $4 minimum wage and, unless it is granted, will go on strike Mar. 10.

SAN FRANCISCO—Mar. 1

Standard Oil Company of California has taken a lease on seven acres of harbor land at Port Los Angeles. The rental is $6,000 a year. Company will construct a loading station, including tanks and warehouses, at a cost of $100,000. The wharf will be erected by the harbor commission at a cost of $20,000. The Standard will pay approximately $15,000 a year in wharfage charges.

Southern Sierra Power Co. is authorized by the State Commission to issue $150,000 first-mortgage 6% 25-year bonds. The commission gave the company authority a year ago to issue $300,000 of these bonds, and in August the company reported that it had sold one-half of this amount and asked permission to sell $150,000 of first and refunding 6% 50-year bonds in lieu of remaining amount of the first issue. The present order is the result of recent request.

The Magnesite Mines at Porterville, Tulare County, form the largest magnesite-producing district in the United States, if not in the world. There are at present nine separate camps taking out ore. More than 200 men are regularly employed. The Tulare Mining Co., the oldest commercial magnesite concern in the country, and the Porterville Magnesite Co., have their reduction plants in operation. The Magnesite Mining Co. has ordered machinery for installation of reduction works. The Tulare Mining Co. has a large property east of Porterville. The loading station is known as Magnesite.

California-Oregon Power Co., by consent of 90% of the holders of first and refunding bonds, will save interest for a period not to exceed 5 years. The securities have been deposited with the committee authorized to settle with the company either for cash or stock covering interest and default. The first coupons to be passed were dated Jan. 1, 1916. The company has authorized an outstanding $10,000,000 common stock. General bonds and divisional bonds amount to a total of $4,400,000; and general bonds have been deposited to secure floating debt of several hundred thousand dollars. The debt has been paid and the company is earning approximately enough to pay interest on general bonds, but this interest was waived in order to apply to construction, now under way and to be completed.

The High Wages of the Copper Camps are attracting copper miners who have recently been working in the gold mines of Grass Valley and Nevada City districts, who are leaving for Montana, Michigan and Arizona to take advantage of wages which have been increased with the advance in price of copper. This in spite of the recent bonus offered by the gold-mine operators. The miners who are leaving, however, are said to be chiefly copper miners and probably prefer that branch of work. The exodus has not yet interfered with the labor situation materially and probably will not, as gold miners seem to be plentiful. Possibly a shortage of skilled men may develop, which is not expected to last long, because Nevada County operators have the reputation of paying top wages and treating their men right.

Northern California Power Co. board of directors was re-elected unanimously after several stockholders had protested against present management. President's reports indicated that it would be necessary to raise $700,000 by assessment within 18 months, for the payment of debentures amounting to $500,000 and the bond sinking fund amounting to $115,000. The money will be needed for betterments and improvements which will amount to approximately $200,000 in excess of the amount available from revenues. The income account for 1915 showed gross operating revenue $776,972; maintenance, operating expenses, taxes, etc., $342,452; net from operating, $434,520; miscellaneous income, $8,511, making a total net income, $443,031. After paying interest on bonds, etc., there was a balance in the treasury of $79,429.

Government Oil Land Suits against the Southern Pacific and 150 other defendants were resumed in the United States Circuit Court before Judge B. F. Bledsoe at San Francisco recently. The trial is expected to occupy three weeks at San Francisco, after which the Court wild hold sessions at Fresno and Los Angeles. The Government seeks to recover 160,000 acres of oil lands in San Joaquin Valley and $30,000,000 damages for oil lands already sold by the railroad company. These lands are included in the enormous land grant obtained from Congress July 27, 1866, by Huntington, Hopkins, Stanford and Crocker, known as the "Big Four." The Government will seek to show in court that when patent was obtained in 1894, on affidavits that the lands were chiefly agricultural, a fraud was perpetrated upon the Government, as the defendants knew at the time that the lands were chiefly valuable for mineral oil. Evidence of this is sought in the reading into the record of the Court the correspondence exchanged between the commissioner of the land office and Jerome Madden, land agent for the railroad. These letters concern a dispute as to who should determine the character of the land involved. The letters show that while the land office officials suspected that some of the lands were mineral in character, the patents were issued and nothing was done to restore the lands to the public domain.

BUTTE—Mar. 2

The Fire in the Pennsylvania Mine is proving one of the most stubborn that has ever occurred in the Butte mines and it now seems likely that the mine will be closed for some time before the fire is extinguished or controlled. Three times during the past week the fire-fighting crews were driven out of the mine by fresh outbursts of flames and smoke. Part of the air shaft has caved in, and there has been some caving in drifts and stopes on the 1,200, where the timbers have burned out. The fire, it is reported, has broken out in most unexpected places in stopes, raises and drifts. One crew has been fighting the fire a quarter of a mile from the main shaft. The inquest, while not resulting in fixing the cause and origin of the fire, brought out stories of unequaled heroism and sacrifice on the part of the miners and rescuers. In recognition of their heroic efforts toward saving their fellow workers, the Anaconda company has made acknowledgment of the services rendered. All who took a prominent part in the rescue work received a personal letter from Vice-President C. F. Kelly, thanking them for what they had done and enclosing in the letters checks ranging in amount from $50 to $250. It is understood that about 60 men were thus favored.

DENVER—Mar. 3

The Control of all Ore-Purchasing Concerns by the state's Public Utilities' Commission, was advocated by the recent convention of the Colorado Metal Miners' Association, a resolution to that effect having been passed by the convention.

Isabella Used to Be a Freak Mine—judged from the stock market "dope"—for its shares fluctuated markedly in response to occasional findings of rich pockets. It is said that prior to the strike in the Cresson vug, the Isabella shipped the richest carload of ore ever produced in the district; but that was years ago. The mine has been quiet for years, but a few days ago the many stockholders were given a thrill on learning of a bonanza shoot being struck on the 1,275 level in the Lee shaft. About a year ago, a rich shoot was mined in a higher level and the last find is in response to development aimed at the extension. Within a 3-ft. vein of high-grade ore, there is a 6-in. streak said to run 800 oz. gold and 70 oz. silver per ton.

Arkansas Valley Smeltery Is the Scene of a Labor Strike begun Feb. 26 when about 600 employees made a demand for increased wages and the adjustment of numerous grievances. Chairman E. E. McLaughlin and Secretary J. A. Warren of the State Industrial Commission immediately went to Leadville to investigate. After being there a short time they published a manifesto addressed to the strikers, explaining that assurances had been secured from the smeltery officials that the minor grievances would be corrected, but also calling attention to the provision of the law forbidding groups of men from quitting work without giving 30 days' notice. The strikers are censured for permitting 13 of their number to remain away from their duties after the commission had secured their release from jail upon their word of honor to comply with the law. Until the laborers return to their duties the commission refuses to push the investigation in their behalf but insists that it will inflict upon the strike leaders the

fullest punishment possible if they do not promptly comply with the law. At this writing, matters are unsettled and arrests are imminent.

Fryer Hill, one of the famous portions of the Leadville district, will be drained if present plans are consummated. The United States Smelting Refining and Mining Co., with headquarters in Boston, is back of this enterprise and has had engineers investigating feasibility of project for several weeks. Upon their favorable report, the company sent H. S. Lee to Leadville to undertake the active management. E. A. Hamilton will have charge of all mechanical and construction matters. The Harvard shaft on the northwest slope of this historic hill has been selected as the center of operations and will be equipped with centrifugal pumps. Present water-level is at 250 ft.; shaft is 407 ft. deep. The shaft being of three compartments, a hoisting engine will be installed to operate bailers in balance in two of the compartments and thus expedite the unwatering. Upon completion of the unwatering, it is proposed to explore the 400 level, which is in blue limestone, and to sink the shaft through the parting quartzite into the white lime that is expected to prove as valuable a formation here for sulphide orebodies as it has been in the neighboring Carbonate Hill. During unwatering, drill-holes are to be put down at numerous points. Meanwhile pumping continues at the Penrose shaft in the Downtown section and the unusually heavy inflow that, for weeks, balked all efforts at lowering the level, has finally been overcome. The level has been lowered now to workings having relatively small volumes, so that the big end of this undertaking seems to have been accomplished.

SALT LAKE CITY—Mar. 3

The Utah Apex Is Now One of the Largest Shippers of Lead in the United States. A contract has been made with the United States Smelting Co. for 300 tons daily of lead-zinc ores, in addition to the daily shipments of 300 to 400 tons of lead ore and concentrates to the American Smelting and Refining Co. at Murray.

The New Sulphuric Acid Plant at Garfield will have construction work started by the Garfield Chemical and Manufacturing Co. The American Smelting and Refining Co. and the Utah Copper interests are understood to be behind the enterprise. The first unit of the plant is to have a daily capacity of 100 tons of acid, and it is expected will be ready for operation Aug. 1.

The Interest in Stocks Continues, and there has been heavy trading on the Salt Lake Mining Exchange. During February 4,591,950 shares of stock valued at $888,471 were traded in as compared with 3,485,548 shares of a value of $562,982 in January. The last two days of the month showed 900,000 shares to have been traded in; and on Feb. 29 sales amounted to 340,107 shares valued at $62,710. Much interest has been taken in Tintic stocks recently. The board of governors has decided that after Apr. 1 no unlisted stock will be dealt in on the exchange. Exchange rules are to be more rigidly enforced in order that more business may be transacted. Seats on the exchange have advanced in price.

MORENCI, ARIZ.—Mar. 3

The Managers and Grievance Committee have concluded their conference and all questions at issue seem to be definitely and permanently settled. The following advances, figuring on 13c. copper as a base, were agreed upon:

Employees Receiving on 13c. Copper Base	Will Be Advanced	When Copper Sells at
20½c. to 24½c. per hr.	10%	13c. and over
25½c. to 33½c. per hr.	10%	13, 14, 15 and 16c.
25½c. to 33½c. per hr.	15%	17c. and over
34c. to 37c. per hr.	5%	13, 14, 15 and 16c.
34c. to 37c. per hr.	10%	17c. and over
37½c. to 45c. per hr.	5%	17c. and over

Carpenters, electricians and machinists are raised to the same wage level and their advance holds good while copper is selling from 13 to 26c. inclusive. Carpenters and electricians were advanced from 46½ to 50c. at 13c. copper; machinists, from 49½ to 50c. at 13c. copper. Present sliding scale to remain effective and there is to be a minimum daily wage of $2. Wages will be figured on price of electrolytic copper for the previous month as published by the Engineering and Mining Journal. A new classification of labor also has been arranged. Instead of having different rates for American and Mexican timbermen, there will be a first- and second-class timberman's rate. Only men who are capable of doing the work of a shiftboss will be eligible to the first-class rate. The managers may point to the fact that they ousted the Western Federation of Miners, recognized no union and raised the wages no greater percentage, perhaps, than many other companies in the country; the miners may say they have a strong union and that they struck for $4.15 a day and practically got it. Thus everybody is happy and the checks are coming regularly.

SPOKANE, WASH.—Mar. 3

Changes in the Staff Personnel at Federal Mining and Smelting Co. have aroused considerable interest and much gossip. Harry L. Day, of Wallace, Idaho, has tendered his resignation as president and general manager and F. H. Brownell, of Seattle, former president, and now chairman of the board of directors, has been chosen to succeed him as executive. H. A. Guess, of Wallace, Idaho, for several years in charge of experimental work for the Federal interests, has been made managing director. The new administration becomes effective immediately, Mr. Day having requested to be relieved of his duties at once. Mr. Day, who is heavily interested in the Hercules and Tamarack & Custer mines in the Cœur d'Alenes, became president and general manager of the Federal company in June, 1912, succeeding Mr. Brownell, and it was the gossip among mining men that he had been made head of the corporation through the influence of the American Smelting and Refining Co., the controlling factor in the Federal in return for his alleged assistance in securing smelting contracts for the output of the Hercules and Tamarack & Custer. The contract with the Hercules company expired May 29, 1915, and the Day resignation has been rumored ever since.

JOPLIN, MO.—Mar. 3

The New Producers Added to the List of Active Properties in the Joplin district during the month of March will have a weekly production of several hundred tons of concentrates. Upon the lease of the Zinc Corporation of Missouri there will be added 10 mills ranging from 250 to 400 tons capacity daily. Five are already started on their initial runs. These are Kirkwood, Zinc Fields of Missouri, Ben Franklin, Hornbrook and the Kusterer Custom plant. Those under construction are two plants by the Mattes Bros., and one each by the Queen Esther, F. C. Wallower, and J. F. Dexter Mining companies. These should produce a minimum of 250 tons of concentrates weekly and a possible maximum of 500 tons weekly. In the same region are the new plants of the Century Zinc Co., the Davis Mining Co., and the Cinnemo Mining Co., besides a few others that are not yet under way but have plans completed and are ready for construction. At Aurora a new 300-ton mill has been built, while at Springfield three new mills are now running, and at Ash Grove three more are under construction. In the Joplin camp, F. A. Gager has built a new tailings mill and the Little John Mining Co. has completed a plant. At Granby, Perkins and Underwood have a new tailings mill erected. In the Miami camp eight new mills will be running soon. At a minimum estimate these plants will add still another 600 tons of concentrates weekly. The district therefore can normally anticipate about 1,000 tons weekly increase in production after March.

TORONTO, ONT.—Mar. 2

The Northern Ontario Light and Power Co.'s decision to extend its transmission lines further north will have an important effect on Kirkland Lake. This camp has been handicapped for power, as the timber is becoming scarce, and with the mines several miles from the railway, and the roads poor, the cost of coal-generated power is very high. There is a surplus of 3,000 hp. in Cobalt, and this will be available for the mines of Kirkland Lake and the adjacent camps. The new transmission line will be about 50 mi. long.

Keen Discussion of the Nickel Policy of the government was a marked feature of the debate on the Budget in the Canadian Parliament, which closed last night. This was strongly assailed by J. G. Turriff, of Assiniboia, and W. F. Maclean, of South York. It was charged that the International Nickel Co. was controlled by the Krupp and other German interests, and that, notwithstanding all assurances to the contrary, a portion of the output of the New Jersey refineries found its way to Germany. The Government, it was urged, had been derelict in its duty, in not insisting that all Canadian nickel should be refined in Canada.

Solicitor General Meighen warmly defended the course of the government. He read correspondence showing that the British war authorities were perfectly satisfied with the existing measures adopted to prevent supplies reaching the enemy, and he presented a statement showing that out of 469,441 shares in the International Nickel Co. only 158 shares of common stock, and 263 shares of preferred stock were held by persons in Germany and Austria. The profits of the company, he said, were $5,000,000, instead of $25,000,000 as stated. While it might be desirable later to impose a duty on nickel ore in order to encourage the establishment of refineries in Canada, to do so at the present time would cut off the supply of nickel for the munitions of war now being manufactured for the Allies in the United States. The tone of Mr. Meighen's speech renders it abundantly evident that the government has no intention of disturbing the present situation by adopting any measures for the restriction of nickel exportation.

The Mining News

ARIZONA

Cochise County

JOHN GLEESON (Tombstone)—Has recovered from Mary Costello by verdict of superior court one-third interest in about 20 mining claims, situated in the Turquois district. Property valued at over $1,000,000; case of long standing.

Gila County

INSPIRATION (Miami)—Is mining and milling 12,000 tons per day. Mill has final, 18th unit going; mines running three shifts.

STONEWALL JACKSON (McMillan)—Mine will be unwatered and 540-ft. shaft will be deepened several hundred feet. Water caused suspension of operations in December until larger pump could be installed. Drift is being run on vein of pay ore on 470-ft. level, in which some black sulphide of silver occurs.

IRON CAP COPPER (Globe)—Company shipped 26 cars of 10% ore to El Paso during January and important orebodies were opened up. New boiler has been installed and collar of shaft is being concreted. Shaft will be enlarged and sunk several hundred feet deeper. Company has secured title to Bird group of 10 claims and Bird extension group of 8, which adjoins the Iron Cap on the north. Company has had property under bond for 3 years; consideration said to be $125,000. Directors are considering issuance of $125,000 refunding 7% first-mortgage five-year bonds.

Maricopa County

FORTUNA (Phoenix)—Lane roller mill recently installed in Winnifred district, 23 mi. north of Phoenix.

CHRIS. MARTIN (Phoenix)—Is operating his retort on quicksilver property in the Sunflower district. Ore is high-grade.

CHAS. REAKSECKER (Aguila)—Has installed small stamp mill on gold property, 20 mi. south of here, and made a satisfactory cleanup.

LARSON AND HUGHES (Phoenix)—Have bonded claims in Mazatzal quicksilver belt and installed a retort. Property is in the Sunflower district.

Mohave County

UNITED EASTERN (Oatman)—A 60-hp. hoist ordered to replace a 22-hp. over No. 1 shaft; 1,000-cu.ft. compressor to be used at No. 2 shaft has arrived.

TIMES MINING (Oatman)—Retimbered shaft will be sunk from 144-ft. to 500-ft. point. Company has just installed 250-hp. gasoline hoist, 500-cu.ft. compressor, 80-hp. gasoline engine, several drills and drill sharpener.

PUTNEY (Oatman)—Controlled by Long, McIver and J. Parke Channing, is working three shifts sinking two-compartment vertical shaft. A 40-hp. gasoline hoist has been installed; 300-cu.ft. compressor, which has arrived, will go into commission in few days. Expect to sink 6 ft. per day after mechanical equipment is operating.

FRISCO GOLD MINES (Kingman)—Is making preparations to resume development operations on scale exceeding previous work. Mine was inactive for about one year, but recently employed force of men and is engaged in overhauling equipment and repairing underground work. Property has 150-ton reduction plant; is located in Union Pass section.

Pima County

STUMP (Silverbell)—Reported that George Daily, of Tucson, has bended property to Thomas Traylor, of Denver, for $100,000.

Yavapai County

WICHMANN (Yucca)—Excellent showing being made in development of tungsten ores. Milling plant to be installed by J. C. Wichmann.

EL DORADO (Crown King)—N. H. Getchell and associates have acquired El Dorado from Frank E. and Edward Wager, former owners of Tip Top.

RINCON (Congress)—Joe Cumbach, in charge of Rincon, recently taken over by Dixie Mines Co., is unwatering mine and preparing for much development work. Company has $35,000 development fund.

BLACK ROCK (Wickenburg)—Property being put in shape for campaign of deep development; is equipped with compressor, hoist, drills and 40-ton mill. Frank McLean, recently of London, Ont., is manager.

MAJOR MINING AND MILLING (Walker)—Poland Milling Co. has sold its 20-stamp mill to Major Mining and Milling Co. Latter will double capacity of mill and will also build a 150-ton cyanide plant. This company has about 5,000 tons of gold ore in Eureka mine that runs $20 per ton.

LINCOLN (Crown King)—D. H. Bradley, of Parral, Mexico, representing Philadelphia capitalists, has taken over Lincoln and put 20 miners to work; force will soon be increased. Lincoln produced $400,000 under primitive methods; last shipment of old company averaged $83 a ton. Fifteen-stamp mill on ground has recently been overhauled.

Yuma County

STEECE (Parker)—After idleness for several years, due to litigation, property to be reopened.

BENDIGO (Parker)—A 600-ft. shaft is to be sunk. Ten car loads of ore shipped recently having net average of $68 per ton.

CALIFORNIA

Amador County

CONSOLIDATED AMADOR (Sutter Creek)—Company reopening Old Eureka will install new steel headframe.

TREASURE (Amador City)—Property prospected and sufficiently developed to determine necessity for mill and grading begun for it. J. H. Bell is superintendent.

ARGONAUT (Jackson)—Installation of underground electric hoist at 3,900 ft. level is in progress. Company preparing for construction of dam to provide reservoir for storage of tailings.

PLYMOUTH CONSOLIDATED (Plymouth)—Preliminary monthly report shows 10,000 tons ore milled, gross value, $57,000. Operating expenses $22,706; development $2,465; charged off, $4,312; surplus, $22,517. James F. Parks is superintendent.

Butte County

MANGANESE DEVELOPMENTS at Clipper Mill will be actively undertaken by Noble Electric Steel Co. and ore shipped to Heroult, Shasta County.

SUNBEAM (Yankee Hill)—Reported 5-stamp mill will be installed. Property owned by J. L. Dvelter & Bros., Gus Forthouse and L. H. Fields.

BANNER MINES (Oroville)—New consolidation includes Old Banner, South Banner, Amoskey, Clark and Coffee claims. Development in progress on Amoskey and South Banner with 20 men; shaft down 600 ft. in good ground. A 75-hp. engine and modern hoist installed. First unit of 10 stamps will be installed this summer. Richard Phillips is manager.

Calaveras County

ROYAL CONSOLIDATED (Hodson)—Reported that 20 of 50 stamps will be shut down; and crushing rolls and flotation plant substituted.

Colusa County

QUICKSILVER SHIPMENTS, first from mines in Sulphur Creek district for 10 years, have recently been made, creating renewed interest in cinnabar deposits in the Manzanita, Wide Awake, Elgin, Abbott and others.

Kern County

CONSOLIDATED (Randsburg)—Reported ledge of scheelite 3½ ft. wide disclosed. Drifting on the new vein in progress, ore said to average about 10%. High-grade sold to Atolia Mining Co. at $60 per unit.

Los Angeles County

HERCULES POWDER CO. has let a contract to C. C. Moore & Co., of San Francisco, of over $500,000 for the erection of plant in San Diego, to make potash from kelp. Swift & Co. is also building new potash plant at San Diego.

Nevada County

GOLDEN CENTER (Grass Valley)—Milling capacity to be increased as soon as satisfactory investigation has been made of various types of mills.

Shasta County

MIDAS (Knob)—High-grade ore strike made in foot wall of a middle vein hitherto not largely developed, but known as good producer. Strike of great importance to camp as ore shoot has been opened 100 ft., with every indication of persisting to deep levels.

Sierra County

EASTERN CROSS (Alleghany)—Bonded to C. A. Jackson and associates. Compressor and other machinery to be installed.

MONARCH (Sierra City)—Shaft being sunk to 400-ft. depth, when tunnel will be started; will give 700 ft. backs. West drift in 300 ft. on vein. Tailings being impounded. D. McGonigal in charge.

SIERRA BUTTES (Sierra City)—Rich ore struck on North Cliff ledge, but operations were stopped by snowslide which carried away all snowsheds, 4 trains of ore cars, part of compressor and building, and portion of mill building. Repairs and resumption of development will begin early this spring. Hayes Brothers, San Jose, Calif., owners.

Siskiyou County

GREY EAGLE (Happy Camp)—Reported large amount ore 6% copper and $3.50 per ton gold and silver is shown by development work. Mine is 12 mi. west from Blue Ledge mining district, on the Klamath River.

CLASSIC HILL (Happy Camp)—Working to advantage with 3 large giants. Formation is decomposed quartz containing large pockets free gold. Mine worked for past 12 years under management of C. Scott Greening.

GOLD KNOB (Gottville)—Developed about 15 months ago and made a good showing of vein from 4 to 20 ft. wide with high-grade ore. Property recently sold by D. T. Irwin to M. G. Munly, of Oregon. Development continuing and number of men will be increased.

Tuolumne County

RAWHIDE (Jamestown)—Unwatering the shaft has progressed favorably to 400 level. Stated that good ore is disclosed on 300 level. John Mocine is manager.

COLORADO

Boulder County

VASCO (Boulder)—Has leased Boyd mill in Boulder and will remodel plant for treatment of tungsten ores.

BOULDER TUNGSTEN (Boulder)—Main crosscut advancing about 6 ft. per day. Several veins cut recently, three disclosing pay ore.

U. S. GOLD CORPORATION (Boulder)—Mill in satisfactory operation now treating about 1,500 tons per month. Contracts for several hundred feet of new development recently let. A winze being sunk from fourth level in Nyanza ore shoot.

BRACKEN (Boulder)—Lease on April Fool lode secured by I. N. Blair; installing machinery to sink shaft additional 100 ft. to 217-ft. level. Vein of tungsten ore opened in shaft at a depth of 100 ft. Electrically operated compressor of 470 cu.ft. capacity being installed. Total force of 25 men employed in development. C. C. Bracken is manager.

Clear Creek County

GRAND CLEAR CREEK TUNNEL (Idaho Springs)—A 12-in. vein of lead-zinc ore has been opened. E. R. Willey is superintendent.

JACKSON MILL (Idaho Springs)—Plant leased to Gustafson and Filgren, being equipped with two Huntington mills and five sets of jigs, which will increase mill's capacity. Planned to operate about Mar. 15. Custom ores will be treated.

FRENCH FLAG (Idaho Springs)—Estimated that water will be lowered to 200 level in about 10 days. Silver Age level will be unwatered at about 100 ft. whereupon pumps will be placed in working order. Company plans extensive development work. C. H. Ripley is manager.

ONONDAGO (Georgetown)—Developing the Ruler vein through the Capitol tunnel. When new equipment is in order development will proceed on three different levels. Company has absorbed Doric Tunnel properties and will commence development through this tunnel within about 60 days.

San Juan County

COPPER KANNUCK (Gladstone)—Being developed by Taylor & Riggs. Large quartz vein opened, of milling ore. containing 2-ft. streak copper ore assaying over 20%. Hübnerite found in property adjoining.

KITTIMAC (Silverton)—New vein opened in East drift widened to 4 or 5 ft. and assays indicate milling ore. Snowslide destroyed upper tram terminal, but damage will be repaired soon. Work at new mill temporarily suspended on account of coal shortage. Difficulty overcome by opening of Silverton Northern R.R.

San Miguel County

MATTERHORN (Telluride)—Recent exploration opened pockets of rich ruby silver ore. Otto Beselack is manager.

SILVER CHIEF (Telluride)—Small force engaged to clean out and retimber lower levels. Property recently acquired by Weeks & Co., Leroy Parker, manager. Present activity preliminary to campaign of development.

Teller County

VINDICATOR (Independence)—Ore has been found on 1,900 level where country rock was expected. Driving for this new vein on 2,000 level.

IDAHO

Shoshone County

RAY-JEFFERSON (Wallace)—Material being delivered for 250-ton concentrator.

SUCCESS (Wallace)—Reported that contract with Grasselli Chemical Co., terms of which reported favorable will be renewed at expiration in May.

INTERSTATE-CALLAHAN (Wallace)—Report for quarter ending Dec. 31, shows net profit of $721,748. Between Apr. 1, 1915, and Dec. 31, company disbursed in dividends $2,557,445. Shaft now being sunk 400 ft. to 1,000 ft. depth below present main working tunnel.

YANKEE BOY (Kellogg)—Big Creek Leasing Co., leasing ground below No. 3 tunnel struck vein in crosscut from raise 300 ft. high and about 200 ft. below tunnel. Strike disclosed 9 in. gray copper running high in silver, also 5 to 6 ft. of additional vein material. Pay streak while small, is rich in silver.

MICHIGAN

Copper

OLD COLONY (Houghton)—Diamond-drill work at this and adjoining Mayflower property proceeding slowly, due to shattered formation and lost drill bits.

COPPER RANGE (Painesdale)—Has announced the largest bonus yet offered in the district. It amounts to 20% on wages of all employees who work during March and April. About 2,000 men benefited. Company has been giving 10% a month for several months; other corporations paying 5% a month.

Iron

AMERICAN (Diorite)—Strike settled and all men back at work.

ATHENS (Negaunee)—Shaft now down 1,300 ft. will go down 2,400 ft.

NEGAUNEE (Negaunee)—Forty-five thousand tons mined in February; over 400 men employed and more will be taken on if they can be found. Good miners scarce and shortage of labor is certain in entire district by spring.

HOLMES (Ishpeming)—Shaft now being concreted to ledge, at 47-ft. depth; sinking will be resumed on completion. Temporary surface buildings to be replaced by permanent structures and steel headframe to be erected in the spring.

NEWPORT (Ironwood)—New Woodbury shaft holed through on 21 level having been put down over 2,000 ft. in less than a year. Connection made with old shaft by a drift run several hundred feet. Woodbury shaft will go down about 200 ft. deeper and will then be concreted from bottom to collar, so probably will be July or August before ore will be coming through it. Best month's sinking was 206 ft.

MINNESOTA

Duluth

MINNESOTA STEEL (Duluth)—Second blast furnace blown in and the two furnaces now being worked to capacity. Seven of the open hearth furnaces going and soon other three will be in shape. Cement now being made at Universal Portland Cement Co. plant near steel plant, slag from steel plant being utilized and limestone being shipped in from Calcite, Mich. First shipment of cement made this week.

Cuyuna Range

BRAINERD-CUYUNA (Brainerd)—Operations suspended pending endeavor to refinance company.

CUYUNA-SULTANA (Ironton)—Ore pockets are being added. One car per day is being shipped to Duluth.

THOMPSON (Crosby)—During coming season, three methods of mining will be used on property—open pit, underground and milling. This will be first Cuyuna mine to use milling method.

ADBAR DEVELOPMENT CO. (Loerch)—At depth of 50 ft. operations in company's Tabert shaft were temporarily discontinued on account of "boil." Pumping equipment of sufficient capacity has been ordered to overcome difficulty. Property is near Wilcox mine at Woodrow.

Mesabi Range

HARTLEY-BURT (Chisholm)—Stripping will be started with one shovel as soon as ground thaws.

LEONARD-BURT (Chisholm)—Stripping will be started about Mar. 6, with one shovel and three locomotives.

M. A. HANNA CO. (Virginia)—Silver, Brunt and LaRue mines will be operated to capacity this season. Electric haulage recently installed at Silver and electric compressor plant is to be put in.

BUHL—Additions to be made to change houses at Deacon, Shiras and Wanless mines. More men to be worked this season. Electric equipment for haulage being installed at Shiras and Wanless mines, also large electric generator. Culver and Wabigon mines probably will not be worked this year.

SILVER (Virginia)—Electric haulage system installed. Electric compressor system being installed; power being furnished by Great Northern Power Co. Considerable "scramming" being done; ore being dumped into pit, to be removed later by steam shovel.

MONTANA

Jefferson County

ALTA COPPER AND SILVER (Corbin)—Final payment made for famous Lloyd group of four claims near Corbin. Company composed of Butte men who expect to produce ore within 30 days.

Lewis and Clark County

SCRATCH GRAVEL (Helena)—Reported strike of ore on 200 level, 2½ ft. wide.

Lincoln County

BANNER & BANGLE (Troy)—Several hundred men will soon be put at work to develop mine, install hydro-electric power plant and build a 7-mi. electric railroad. Several companies preparing to mine gold gravel in district south of Libby, where rich deposits were discovered on Bear Creek Co. property.

Silver Bow County

BOSTON & CORBIN (Wickes)—Operating in the Wickes district, has a deal pending to take over Rock Rose, a gold-silver-lead property in Grass Valley district.

BUTTE & SUPERIOR (Butte)—February proved another record breaker, the total output being 55,360 tons of ore, producing zinc in the concentrates of more than 16,000,000 lb.

BUTTE & LONDON (Butte)—Shaft has reached 1,400 ft.; station being cut. Contract with Rainbow Dev. Co. which is doing work, calls for a further depth of 200 ft. before crosscutting probably by middle of April. Indications in the shaft are improving steadily.

BUTTE CENTRAL (Butte)—Judgment in suit of L. Wilton Strong against Butte Central and Boston Copper and others in favor of plaintiff was issued Feb. 19 by district court. Judgment directs that property of defendant company be sold to satisfy claim, that proceeds be paid to plaintiff and any balance to those entitled thereto.

EAST BUTTE EXTENSION (Butte)—With resumption of activities, owners of properties of this company are considering plans to put claims into operation or make some disposition of them. Company owns about four acres of fractional claims lying between Pennsylvania, Belmont and Squirrel mines of Anaconda company. There are six shafts on these fractions. Company also owns interests in various claims, located close to properties that are in active operation.

OPHIR (Butte)—This old silver mine, located in southern section of camp to be reopened by a new corporation known as the Butte-Detroit Copper and Zinc Mining Co., incorporated in Delaware, capitalized at $2,500,000. Mine has been worked spasmodically for silver ores. In recent years operated by Butte Central and Boston Copper companies who erected modern mill. New company backed by principal stockholders of old company, and will develop deposits of zinc ores predicted will be found in the lower zones of mine.

ANACONDA (Butte)—At Lexington mine work of unwatering lower levels continues. New machinery installed. At Alice mine, north of Lexington, shaft repairing above water level continues. Unwatering will probably not be started until Lexington and Emma are in shape for operation. Appeal taken by minority stockholders in Alice case will have no effect on plans for operating. At Nettie mine repairing underground workings proceeds rapidly. Entire mine unwatered and large new pump being installed on 500-ft. level. Expected to have mine ready for operation within 60 days.

NEVADA

Esmeralda County

GOLDFIELD CON. (Goldfield)—Expects to complete first 50-ton unit of 200-ton flotation plant before Apr. 1.

BLACK BUTTE (Diamondfield)—Contract pending for construction of flotation plant with interests represented by Harry Ginnitty. A 150-ton plant will be built to treat company dump.

SILVER PICK (Goldfield)—Company announces that Calyx core drill has been ordered and will soon be in operation at property prospecting ground below their present lowest levels.

Nye County

TONOPAH ORE PRODUCTION for week ended Feb. 26 was 8,307 tons valued at $174,786 compared with 8,700 tons for week previous. Producers were: Tonopah Belmont, 3,018; Tonopah Extension, 1,800; Tonopah Mining, 1,725; Jim Butler, 750; West End, 547; Halifax, 130; North Star, 60; miscellaneous leases, 277 tons.

REORGANIZED WHITE CAPS (Manhattan)—Since reorganization late in 1915 property has been unwatered and crew now employed in sinking an additional 100 ft. to the 310-ft. level. J. A. Cole, superintendent.

RESCUE-EULA (Tonopah)—Deepening main shaft to the 1,100-ft. level completed and station being cut. Stated that 4 ft. of $40 ore struck on the 950-ft. level is presumably extension of the Occidental vein, first developed in the Belmont property.

JIM BUTLER (Tonopah)—Statement covering last half 1915 gives net income as $141,702. Of available assets, $183,924 was in silver bullion stored at 50c. per oz. The apex suit, Jim Butler vs. West End, was argued on appeal before State Supreme Court the last week in February.

KANSAS CITY-NEVADA CONSOLIDATED (Bruner)—Organized under laws of Nevada, has taken over Fife and Bills or Duluth Mining Co.'s property, also Big Henry, Phonolite Paymaster Mining Co. and the Phonolite Silent Friend Mining Co. Steps being taken to put $100,000 cash in treasury for development purposes and for erection of mill this summer.. E. F. Sooy, vice-president of the Lucky Tiger Gold Mining Co., is president; the home office is 411 Commerce Building, Kansas City, Mo.

Storey County

ANDES (Virginia)—Extracted 21 tons from intermediate level stope.

UNION CONSOLIDATED (Virginia)—Extracted 436 tons of gross value of about $10,000. No. 1 stope, 82 tons, $16.25; No. 2 stope, 122 tons, $38.55; No. 4 stope, 232 tons, $16.89.

SIERRA NEVADA (Virginia)—Disclosed 3 ft. of $25 ore in bottom of winze of No. 1 stope, 2,500 level. Extracted 85 tons ore from north end of No. 1 stope, average $21.10.

MEXICAN (Virginia)—Prospecting drifts on 2,500 and 2,700 levels continued through porphyry and quartz of low assay; strong formation. Mexican mill crushed 521 tons custom ore, averaging $23.

CROWN POINT-BELCHER (Gold Hill) — Saved 63 cars from advance of north drift No. 2 on 1,600 level. Shipped 754 tons dump rock to Jacket mill and bar of bullion to smeltery.

OPHIR AND CONSOLIDATED VIRGINIA (Virginia)—Joint west crosscut 2,700 level passed through vein formation carrying some quartz; reached 384 ft. point from winze station. Central tunnel saved 311 cars of ore from 250 level stope and milled 260 tons.

NEW MEXICO

Dona Ana County

FORBES (Iron River)—Contract is to be let for electrifying part of machinery. Power to be supplied by Peninsular Power Co.

Grant County

SILVER CELL (Pinos Altos)—Rich silver ore reported found in several prospect holes south of old shaft. Company plans 500-ft. shaft; large steam hoist just arrived; ore being sorted and sacked for shipment; will melt richest native silver at property.

Sierra County

SNAKE AND OPPORTUNITY MINES (Hillsboro)—John M. Sully and associates, of the Chino Copper Co., have taken an option on the Snake and Opportunity mines. Consideration, $75,000. Force of workmen has been set to work unwatering and retimbering the main shaft. New shaft is being sunk on Snake, from which crosscuts will be extended to tap veins. This mine formerly produced several million dollars in gold and copper.

Socorro County

MAGDALENA COPPER (Magdalena) — Incorporated with capital stock $1,500,000; by John C. Hamm, of Los Angeles, Wm. Kemp, of Tucson, Judson A. Elliott, of Phœnix, and George H. Briggs, of Magdalena.

UTAH

Beaver County

McGARRY-HODGES (Fortuna)—Lease has several hundred tons ore for treatment at the Sheep Rock mill.

INDIAN QUEEN (Milford)—Resumption of work at this property will be considered at meeting of Knight companies' officials at Provo, Mar. 10. There is 3-ft. vein of shipping lead ore on the 200-ft. level.

Juab County

TINTIC SHIPMENTS in February amounted to 491 cars, estimated at 24,550 tons. There were 23 shippers. In January 445 cars or 22,000 tons were shipped.

Salt Lake County

COTTONWOOD CONSOLIDATED (Salt Lake)—Tunnel in Big Cottonwood is in 366 ft. J. E. Johnson is manager.

UTAH COPPER (Salt Lake City)—January production amounted to 11,989,910 lb. compared with 14,497,485 lb. in December, the decrease being due to snow and bad weather.

ALTA PRINCE (Alta)—Tunnel being driven to reach Prince of Wales fissure at contact between white and blue limestone is now in 1,045 ft. J. S. Hathaway is in charge.

COTTONWOOD KING (Salt Lake)—Iron pyrite and bunches of galena and lead carbonate have been cut in tunnel in Big Cottonwood, now in 1,300 ft. S. A. Parry, J. E. Tadlock, and G. G. Bywater are interested.

SOUTH HECLA (Alta)—Report for 1915 shows production of 3,478 tons, and 1,306 tons mined by lessees. Ores contained 161 oz. gold; 144,066 oz. silver; 914,491 lb. lead; 507,842 lb. zinc; 33,151 lb. copper; and 399,905 lb. iron, bringing a profit of $39,206.

EMMA COPPER (Alta)—Has bought North Star, South Star, Silver Star, and Lucky Star claims at Alta, of Moylan C. Fox. Ground is near some of the former producers of the camp, including famous Emma stope, North Star and Vallejo stopes, etc. Possible litigation has been avoided by purchase, as claims of Emma company intersected those owned by Mr. Fox.

Summit County

PARK CITY SHIPMENTS during February amounted to 5,852 tons, valued at $234,000. approximately. There were 7 principal shippers. January shipments were 7,320 tons.

Toole County

HIDDEN TREASURE (Stockton)—Good tonnage broken by lessees; will be marketed soon.

WANDERING JEW (Stockton)—Property operated by J. W. Carrick; lead and zinc ore mined. Some of zinc ore runs well in gold.

CANADA

Ontario

SMITH-LAKINE (Sesikinika)—Rich ore struck at depth of 35 ft.; is optioned to the Kerr Lake Co.

LUCKY CROSS (Swastika)—Property optioned to interests identified with Trethewey; being unwatered.

FOSTER (Cobalt)—Vein recently struck is 3 in. wide and stated to assay 4,000 oz. per ton. Is being developed on 50 ft. level.

TEMISKAMING (Cobalt)—At the annual meeting old board was reëlected. Main shaft down 1,000 ft.; will be sunk to 1,700 ft.

GORDON CLAIMS (Goodfish Lake)—These four locations are under option to Kirchagami Development Co.; diamond drilling is in progress.

DOME LAKE (Porcupine)—New cyanide plant has arrived on ground and is being erected. Ore will be treated in an inclosed drum under pressure.

LA BELLE KIRKLAND (Goodfish Lake)—Inclined shaft is being put down on good ore. At 187 ft. there is on hanging wall 1½ ft. of ore running approximately $100 per ton.

LA ROSE CONSOLIDATED (Cobalt)—Has taken over Maiden MacDonald claims in Porcupine area. Camps are being built and preparations made for diamond drilling and sinking test pits.

HOLLINGER (Porcupine)—New central shaft concreted down to 425 level. Two veins cut by crosscut on 425 level toward the shaft on the Vipond boundary. A pocket of high-grade struck on the 600-ft. level.

DOME (Porcupine)—February production was $163,480, from 32,040 tons; average $5.10 per ton. Ore struck in new central shaft below 625 level, regarded unsatisfactory, as shaft site was selected to avoid sinking in ore. Some of original 40 stamps will be removed to make room for ball mills, considered more economical for secondary ore-crushing.

MEXICO

Hidalgo

SANTA GERTRUDIS (Pachuca)—Ore crushed during January, 20,502 tons; estimated profit, £16,600.

Sonora

THIRTY-NINE CARLOADS OF LEAD ORE were exported through Juarez, Feb. 26, to the Consolidated Kansas City Smelting and Refining Co. Ore came from Chihuahua. First through train from Mexico City to Juarez since beginning of Villa-Carranza dispute recently arrived in Juarez, via Torreon.

BELLOTA (Nacozari)—J. V. Fryer and associates, have bonded this property, 14 mi. northeast of Nacozari, to Bisbee men.

WASHINGTON MINES (Huepec)—According to F. Oldfield Bostwick, president and general manager, company will install 50-ton concentrating mill. Washington has large body of copper ore containing some scheelite.

NACOZARI CON. (Nacozari)—Will install 60-ton roaster plant. Two-compartment shaft will be sunk to open large new orebody found several months ago in tunnel on 500-ft. level. Diesel engine and hoist have been ordered.

CENTRAL AMERICA

Panama

A MANGANESE-ORE SHIPMENT of about 900 tons has been made to the United States from the mines at Mandinga, on the Gulf of San Blas, in the Province of Colon. The mines are controlled by a New York syndicate.

ASIA

Chosen

ORIENTAL CONSOLIDATED (Unsan)—Cabled report gives February cleanup as $116,800. Output less than January account of grade of ore milled reduced to average and short month.

The Market Report

Metal Markets

NEW YORK—Mar. 8

Lead continued to be the sensational feature. Copper was extraordinarily dull and was softer in tone. Spelter also was dull and exhibited signs of decided weakness.

On Mar. 2 the British government issued an order (referred to in our editorial pages), which was intended to forbid speculation in metals. The London Metal Exchange was immediately closed, except for dealings in tin (which did not come within the scope of the order), and there were no quotations for Thursday and Friday. Upon representations being made to the government by leading members of the Metal Exchange, business was resumed on Monday with severe restrictions. It is required by the government that all outstanding contracts for future deliveries must be liquidated by May 31. After May 31 there are to be no transactions except in metals actually in hand, and for dealing directly with and only with consumers.

Copper, Tin, Lead and Zinc

Copper—Conditions continued about the same as we reported last week. There was one large sale at 26½c., r.t., on Mar. 2, but other than that scarcely anything was done by any of the producers. The principal producers are so well sold ahead that they are indifferent to the dullness, but concerns that have to take in copper right along are anxious to find buyers. They meet the competition of second-hands and also the reselling by such consumers as have overbought. Offers of the latter sort increased the supply of copper available for prompt delivery, and there is no longer much of a premium on that. In the early part of the week copper was freely offered from several quarters at 26½c., r.t., and in the latter part there were sellers at 26c., copper for any delivery from March onward being offered. Copper for delivery in the second half of the year was offered on much lower terms.

The softness in the copper market is not regarded as indicating any crumbling of the main situation, but simply as reflecting the operations of those producers and agencies who need to sell right along. It is the general expectation that the market will rally sharply as soon as the next buying movement shows signs of beginning. It is believed moreover that American manufacturers have not yet fully covered their May and June requirements.

A contributory factor to the dullness of last week was the absence of British and French buying, owing to governmental interference. On Mar. 2 the British Government issued an order forbidding speculative transactions in copper and the other metals. On the same date, the French Government informed manufacturing concerns of its country that it had decided to buy all the necessary copper and zinc and parcel it out. These measures killed all buying demand from individual concerns, which do not yet know just how the business is going to be arranged, and neither of these governments has yet taken any action in the way of buying the metals.

The freight embargo of the New York, New Haven & Hartford R.R., which is maintained very firmly, has put the manufacturers of the Naugatuck Valley in an awkward predicament. At present they are able neither to get metals in nor ship products out, except what are already on the road. They are looking into the practicability of organizing a freight service by trolley between Waterbury and Bridgeport, it being easy enough to transport freight between New York and Bridgeport by water.

Copper Sheets are quoted at 34c. per lb. for hot rolled and 35c. for cold rolled. Copper wire is 28¾@29¼c. per lb. for carload lots at mill.

Visible Stocks of Copper in Europe Feb. 29 are reported as follows: Great Britain, 4,861; France, 4,950; afloat from Chile, 2,300; afloat from Australia, 4,500; total, 16,611 long tons, or 37,208,640 lb. This is an increase of 1,284 tons over Feb. 15, but a decrease of 912 tons from Jan. 31.

Tin—Shortage of supply has maintained spot and near-by tin in a rather tight position. But relatively little business was done during the last week, buyers being reluctant to commit themselves at present prices.

Imports of tin ore and concentrates into Great Britain in January were 2,074 gross tons, of which 1,367 tons were from Bolivia and 589 tons from Nigeria.

Visible Stocks of Tin on Feb. 29 are reported as follows, including tin afloat: United States, excluding Pacific ports, 8,011; London, 7,226; Banka and Billiton, 1,274; total, 16,511 long tons. This is 530 tons less than on Jan. 31, but 1,963 tons more than on Feb. 29 last year.

Lead—This metal was again the sensational feature of the week. Conditions continued of the same character as we reported last week, but were emphasized. On Mar. 3 the A. S. and R. Co. advanced its price to 6.40c., New York, and on Mar. 7 to 6.60c. At neither time, however, did those prices

DAILY PRICES OF METALS IN NEW YORK

Mar.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
2	4.7650	56⅞	26 @26½	47	6.30 @6.55	6.45 @6.55	17.50 @19.50
3	4.7638	56⅞	26 @26½	47	6.40 @6.65	6.45 @6.55	17.25 @19.25
4	4.7663	56⅞	25½ @26½	48	6.40 @6.65	6.45 @6.55	17.00 @19.00
6	4.7625	56⅞	25½ @26	49	6.40 @6.65	6.50 @6.60	16.75 @18.75
7	4.7613	56⅞	25½ @25½	49	6.60 @6.80	6.65 @6.70	16.25 @18.25
8	4.7613	56⅞	25½ @25½	49	6.60 @6.90	6.70 @6.75	16.00 @18.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.25c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Mar.	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb
2	27 1/16	*	*	*	*	185½	185¾	*	*	*	*
3	27	*	*	*	*	183½	184	*	*	*	*
4	27	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
6	26 11/16	101	99½	136	27.97	187	187	31¾	6.76	110	23.42
7	27	100½	99	136	27.98	186	186½	31¾	6.79	102	21.72
8	27	95¾	95	136	27.97	187	186¾	32	6.81	98	20.86

*Market suspended.

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; £60 = 12.85c. Variations, £1 = 0.21½c.

come up to what was previously being realized in the outside market. Both the A. S. and R. Co. and independent producers supplied their regular customers at the quoted price, but buyers who could not obtain lead from them paid what was asked by those who could and would supply them. The largest premium was realized for lead for prompt delivery, or for shipment within the ensuing fortnight. There was a large demand for export, and in buying for that purpose the price that had to be paid apparently cut but little figure.

Spelter—From the very beginning of the week business was dull and the market was weak. Few producers were able to dispose of more than 500 tons apiece during the entire week, and in most cases sales aggregated a good deal less than that. There was pressure to sell from many quarters and in the business that was done prices were accepted that were less than what was openly talked about. The major part of the business transacted was for April-May-June delivery, the prices realized for such ranging from 17@18c. in the first half of the week, but less was got in the second half. Spelter for prompt delivery was also a good deal easier, and sellers were hunting buyers.

The Donora Zinc Co. was reported to have put its eighth furnace in operation a few days ago.

It is rumored that several new zinc smelteries are in contemplation.

Zinc Sheets—Business is active and sales large, but prices are unchanged. The current quotation is $25 per 100 lb., f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Mar. 8

Aluminum—Demand is good and stocks offered are less plentiful. Prices are stronger, 61@63c. per lb. being asked for No. 1 ingots, New York.

Antimony—The market has been rather quiet and sales have not been on a large scale. Prices are firm and slightly stronger. Chinese and American are quoted at 44@45c. per lb. for spot. For late March deliveries 43½c. has been quoted. March shipments from China have been offered at 34¼c. and April at 33½c., both in bond.

Cookson's is to be had only in small quantities and is held at 57@60c. per lb., New York.

Quicksilver—The market has been rather quiet and a little easier. New York quotation is $250@260 per flask of 75 lb., according to size of order. San Francisco reports by telegraph $275 per flask, with small business. The London price seems to be fixed, and does not affect conditions here, owing to the embargo on exports.

Gold, Silver and Platinum

NEW YORK—Mar. 8

Gold Reserves in Canada are estimated as follows: Held by Dominion Government against note issue and savings bank deposits, $120,334,881; held by Chartered Bank of Canada, $60,000,000; in central gold reserve, $6,210,000; total, $186,544,881. This does not include private holdings.

Platinum—There is nothing new in this market. Supplies are still small and prices continue high. Dealers will make no quotations except to regular customers. Sales are reported at $85@95 per oz. for refined platinum.

Palladium—There is some demand for this metal and sales are reported at $55@60 per oz., New York.

Silver—The market has been inactive and price for past week has been steady. The Indian Bazaars continue quiet, although the silver holdings in the currency reserve continue to contract, and the stock is very moderate in size.

Imports of Silver in Great Britain in January were valued at £705,310; exports, £527,624; excess of imports, £237,686, against £406,878 last year.

Zinc and Lead Ore Markets

PLATTEVILLE, WIS.—Mar. 4

The base price paid this week for 60% zinc ore was $115 down to $112 at the week end. The base price paid for 80% lead ore was $82@84 per ton.

SHIPMENTS WEEK ENDED MAR. 4, 1916

	Zinc ore, lb.	Lead ore, lb.	Sulphur ore, lb.
Week	5,104,000	124,000	1,391,360
Year to date	37,526,000	699,700	8,627,620

Shipped during week to separating plants, 6,374,000 lb. zinc ore.

JOPLIN, MO.—Mar. 4

Blende, high price $116.30; base per ton 60% zinc, premium ore, $115; medium grades, $110@100, and lower grades down to $95; calamine, per ton 40% zinc, $85@70; average selling price, all grades of zinc, $110.75 per ton. Lead, high price, $90; base per ton 80% metal contents, $88@89; average selling price, all grades of lead, $88.40 per ton.

SHIPMENTS WEEK ENDED MAR. 4

	Blende	Calamine	Lead	Values
Totals this week.	16,320,830	255,870	2,204,070	$1,015,740
Totals this year..	119,962,870	10,855,050	18,630,570	7,874,210

Blende value, the week, $907,790; 9 weeks, $6,719,480.

Calamine value, the week, $10,090; 9 weeks, $395,060.

Lead value, the week, $97,860; 9 weeks, $759,670.

Another week of winter weather should have advanced prices, but the English decision against the sale of metals has demoralized zinc ore prices. The belief is general that a speedy reaction will occur. In fact, it is reported tonight that one smelting company, buying light for a month, is figuring on heavy purchases if a further cut is made. Outputting is now around 8,500 tons per week, with everything favorable for further increase. Alternate freezing and thawing softened the roads, which, though heavy, permit loading from all but a few outlying mines.

Imports at Baltimore for the past week included 2,100 tons zinc ore from Cartagena, Spain.

Iron Trade Review

NEW YORK—Mar. 8

Advances in prices of iron and steel do not seem to check demand and there are plenty of orders coming in both for domestic and export business.

The mills are exercising some caution, especially on export orders. Some of these have been hard to place on account of the time of delivery asked. Domestic buyers seem, as a rule, to be more anxious about securing the material and about time of delivery than they are about the prices to be paid.

The railroad buying of cars and locomotives has been on a liberal scale. Additional orders for rails have also been placed. Structural steel is active.

The pig-iron market is strong and orders are being placed freely. Some furnaces are disturbed about supplies of coke; and there is also some talk of scarcity of labor.

The present capacity of the Bethlehem-Pennsylvania-Maryland combination is 2,497,000 tons of pig iron, 3,135,000 tons steel ingots and 2,180,000 tons finished steel yearly. In addition the shops can turn out 150,000 tons fabricated steel and the Sparrow's Point shipyard can build seven steamers at one time. It is announced that $15,000,000 will be expended in improvement.

PITTSBURGH—Mar. 7

The advance of one point in black steel pipe and two points in galvanized, made under date of Feb. 29, has been followed by similar advances in wrought-iron pipe. Effective Mar. 1, the leading wire interest announced advances of $2 a ton in regular wire products, making nails $2.40, and two points in woven-wire fencing, to 61½% off list in carload and larger lots, these advances being promptly concurred in by the independents. Following advances recently made by some of the sheet mills others have advanced prices whereby black sheets are $3 a ton and blue annealed sheeets $3 to $5 a ton higher than a week or 10 days ago, black being 2.75c. for bessemer and 2.85c. for openhearth, with blue annealed 2.90c. and 3c. respectively. Contracts with manufacturing consumers are being made to the end of the year in black sheets, and in some instances into next year in blue annealed.

Steel prices have now advanced an average of $21 per net ton since the advancing movement started at the beginning of 1915, taking minimum prices as basis, while prices for prompt shipment have advanced still more. For forward delivery the following commodities have advanced 100% or more: Bars, plates, shapes, hoops, blue annealed sheets, rivets, shafting, cold-rolled strip, billets and rods.

The advancing movement shows no signs of waning, and a further advance of $5 a ton in bars, plates and shapes is expected within a very short time. The buying pressure is about equally divided between prompt delivery, which some of the small mills can make, and far forward delivery, even extending into 1917, a delivery the large mills would not consider until very lately, and for which they are now in some instances charging an advanced price.

Pig Iron—The buying movement continues to broaden. About 50,000 tons of basic have been bought by the smaller steel works in this district in the past week, while the movement in foundry iron has been large and there is now a great deal of inquiry. Practically all the business is for the second half, consumers being evidently well covered to July 1. Prices are up at least 50c., except on foundry, and all grades show signs of going higher, if indeed a spectacular advance is not occasioned by the large steel works coming into the market. The steel works are breaking production records so frequently that their consumption of pig iron may require the purchase

of outside iron. We quote: Bessemer, $20.50@21; basic, $18.50 @19; foundry, $18.50@19; forge, $18@18.50; malleable, $19@ 19.50, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh. W. P. Snyder & Co. announces its computation of average prices obtaining in actual sales in February at $20.2136 for bessemer and $17.984 for basic, both at Valley furnaces, representing a decrease from January of 43.14c. in bessemer and an increase of 15.1c. in basic.

Steel—Mills seem to be still stiffer in their price views, but from one cause or another buyers are found able to pay the high prices, though the average finishing mill cannot, and must run entirely on its deliveries against old contracts, deliveries that are really very good considering the scarcity of steel. A mill making openhearth steel and sheets has bought a round tonnage of bessemer sheet bars at $40, to enable it to divert more of its steel-making capacity to forging billets at $60. We quote billets and sheet bars at $38@40 for bessemer and $39@40 for openhearth, maker's mill, Pittsburgh or Youngstown, with rods at $50@55 and forging billets at $60 per ton.

FERROALLOYS

Ferromanganese—At the recently advanced contract price of the English makers, $175, seaboard, there is little left to sell for the late months of the year, and much doubt as to whether delivery can be compassed, while there is some inquiry for the first half of 1917. Prompt lots when available readily command $250 per ton.

A contract has been made by the Miami Products Co., Chicago, by which one of the stacks of the Iroquois Iron Co., at South Chicago, will be used for the making of ferromanganese, spiegeleisen and other ferroalloys. It is expected that manganese ores from southern California will be utilized at first, and later ores may be imported from Brazil.

FOREIGN IRON

Pig Iron Production in Germany for three years is reported as follows, in metric tons:

	1913	1914	1915
Foundry iron	3,657,326	2,494,527	2,286,670
Forge iron	489,783	370,257	278,684
Steel pig	2,599,887	1,996,786	1,793,865
Bessemer pig	368,840	237,988	187,522
Thomas (basic) pig	12,193,336	9,289,989	7,243,458
Total	19,309,172	14,389,547	11,790,199

Steel pig includes ferromanganese, spiegeleisen, ferrosilicon and all similar alloys. The make for 1915 shows a decrease of 7,518,973 tons, or 39%, as compared with that of 1913, which was a normal year.

IRON ORE

Shipments of iron ore from Lake Erie docks to furnaces in February are reported at 860,266 gross tons. This brings the total stocks on docks on Mar. 1 down to 6,213,729 tons, the smallest for several years. Shipments continue to be made as fast as the railroads can furnish cars, and promise to be heavy in March.

Exports of Iron Ore from the United States for the year ended Dec. 31 are reported by the Department of Commerce at 551,618 gross tons in 1914, and 708,641 in 1915; increase, 157,023 tons. The larger part of these exports were to Canada.

British Imports of Iron Ore in January were 365,812 long tons in 1915, and 526,269 in 1916; increase, 160,457 tons.

OTHER ORES

Antimony Ore is in some demand and sales have been made of good lots at $2.70 per unit. **Molybdenite,** 85 to 90% MoS_2, is quoted at $1.40@1.45 per unit, with a moderate demand.

Tungsten Ore is in very strong demand. The high prices have apparently failed to bring out new supplies. As high as $85 per unit has been paid for prompt delivery.

Manganese Ore brings a high price. A sale of Indian ore is reported at 70c. per unit at tidewater. There is much inquiry for Brazilian ore, considerable quantities of which have been imported lately. Most of these imports, however, have been on contract and there is little on the open market.

Imports of manganese ore in Great Britain in the month of January were 39,413 gross tons in 1915 and 32,111 in 1916; a decrease of 7,302 tons this year.

Imports of manganese ore in the United States year ended Dec. 31 were 283,294 gross tons in 1914 and 320,782 in 1915; increase, 37,488 tons.

COKE

Coke production for the week in the Connellsville region is reported by the "Courier" at 445,200 short tons; shipments, 457,838 tons. Shipments of Greensburg and Upper Connellsville districts, 46,352 tons.

The total coal and coke carried over 13 leading Eastern railroads in November is reported by the Department of Commerce at 17,786,614 short tons in 1914 and 24,600,533 in 1915. For the five months July 1-Nov. 30 the total was 99,507,374 tons in 1914 and 117,206,846 in 1915; increase, 17,699,472 tons.

Coal and Coke Tonnage, Pennsylvania R.R. lines east of Pittsburgh and Erie, month of January, short tons:

	1915	1916	Changes
Anthracite	886,233	1,136,878	I. 250,645
Bituminous	3,498,936	4,314,806	I. 815,870
Coke	684,133	1,191,732	I. 507,599
Totals	5,069,302	6,643,416	I. 1,574,114

The total increase this year was 23.7%. The gains were in all classes of the shipments, coke showing the largest proportional increase.

Exports and Imports of Coal and Coke in the United States for the year ended Dec. 31, as reported by the Department of Commerce, in long tons:

	Exports		Imports	
	1914	1915	1914	1915
Anthracite	3,830,244	3,542,971	19,347	2,998
Bituminous	13,801,850	16,726,283	1,375,316	1,521,237
Coke	592,487	799,444	120,777	47,520
Bunker coal	7,266,002	7,464,630	.....	.....
Total	25,490,583	28,533,328	1,515,440	1,571,755

The bunker coal or coal furnished to steamships in foreign trade, is practically all bituminous. The larger part of the trade, both exports and imports, is with Canada.

Chemicals

NEW YORK—Mar. 8

The general market continues to show a good undertone and a fair amount of business.

Arsenic—Demand continues good, and the market is strong with firm prices. Holders are asking $6 per 100 lb. for early delivery, though some odd lots have sold for $5.75. For futures $6.25@6.50 per 100 lb. is named.

Copper Sulphate—The market is a little more active. Business has been done at $22 per 100 lb. for carload lots and $22.25 per 100 lb. for smaller parcels.

Nitrate of Soda—Production in Chile in January is reported at 256,440 tons, a very large increase over the previous year. Attempts to restrict production seem to have failed. The market is a little easier and $3.60 per 100 lb. has been accepted for spot nitrate.

Sulphur—Owing to the difficulty in getting vessels, shipments from Louisiana have had to be sent by rail at higher cost, and the extra costs have added to the price. Current quotations are $28.50 per 100 lb., New York.

Imports and Exports of Chemicals in the United States year ended Dec. 31, as reported by the Department of Commerce:

	Imports		Exports	
	1914	1915	1914	1915
Arsenic	4,079 372	3 573,624	700	9,775
Bleach	34,539,934	7,4e4,473	15,990	120,126
Acetate of lime	.....	.....	47,896,901	19,767,874
Calcium carbide	.....	.....	32,750 320	37,379,995
Potash salts	31.777 727	14.686 270	537,706	989,825
Sodium cyanide	2,423,171	4,178,058	.....	1,897,727
Soda salts, value	$654,654	$450,383	$13,662	$40,358

Exports include reëxports of foreign material. This statement does not include nitrate of soda nor the crude potash salts used chiefly as fertilizers.

Imports and Exports of Raw Material for chemical manufacture year ended Dec. 31, as reported by the Department of Commerce, in gross tons:

	Imports		Exports	
	1914	1915	1914	1915
Sulphur	22 810	24.647	98,472	37,487
Pyrites	97 372	974 616	.....	.....
Chrome ore	74 686	76 465	.....	.....
Magnesite	17,063	24,619	1,529	414

Exports include reëxports of foreign material. Estimating contents of pyrites the total imports of sulphur in 1915 were 414,493 tons.

PETROLEUM

Exports of petroleum from the United States in January are reported at 146,293,782 gal. in 1915, and 172,199,098 gal. in 1916; an increase of 25,905,316 gal., or 17.7% this year.

The monthly statement of the "Oil City Derrick" gives new wells completed in February as follows: Pennsylvania grade, 395; Lima-Indiana, 45; Central Ohio, 55; Kentucky, 32; Illinois, 82; Kansas, 208; Oklahoma-Arkansas, 588; Texas Panhandle, 42; North Louisiana, 56; Gulf Coast, 104. The total number was 1,607, with an aggregate daily production of 143,997 bbl. There were 164 gas wells and 279 dry holes reported.

Assessments

Company	Delinq.	Sale	Amt.
Adventure, Mich	Mar. 20		$0.50
Adventure, Mich	July 20		0.50
Albany, Ida	Jan. 20	Mar. 11	0.0005
American Copper, Utah	Feb. 29	Mar. 15	0.0025
Basalt, Nev	Mar. 8	Apr. 6	0.003
Beaver, Utah	Mar. 18	Apr. 8	0.01
Cash Boy, Nev	Feb. 16	Mar. 20	0.01
Con. Virginia, Nev	Mar. 14	Apr. 4	0.05
Diamond Queen, Utah	Feb. 22	Mar. 14	0.001
East Caledonia, Ida	Mar. 21	Apr. 10	0.01
Emerald, Utah	Mar. 15	Apr. 11	0.00½
Enterprise, Ida	Feb. 4	Mar. 20	0.002
Federal Ely, Nev	Mar. 1	Apr. 3	0.005
Federal Ely, Nev	Apr. 1	May 1	0.005
Federal Ely, Nev	May 1	June 4	0.005
Flagstaff, Ida	Mar. 20	Apr. 15	0.002
Four Timbers, Ida	Feb. 24	Mar. 24	0.002
Imperial, Ida	Feb. 19	Mar. 20	0.003
Mayflower, Ida	Mar. 15	Apr. 15	0.005
Monarch Pitts, Nev	Feb. 18	Mar. 20	0.01
Mountain Rose, Ida	Mar. 8	Apr. 8	0.001
Native Silver, Mont	Feb. 21	Apr. 4	0.0025
New Bonanza, Utah	Feb. 28	Mar. 18	0.00125
New Quincy, Utah	Mar. 11	Mar. 30	0.01
Old Veteran, Idaii	Mar. 9	Apr. 1	0.002
Ophir, Nev	Mar. 22	Apr. 12	0.05
Paloma, Utah	Mar. 18	Apr. 8	0.01
Park Gold, Utah	Apr. 1	Apr. 20	0.001
Queen Bess, Utah	Feb. 20	Mar. 20	0.005
Rico-Argentine, Colo	Feb. 25	Mar. 13	0.005
Rockford, Ida	Mar. 15	Apr. 15	0.001
Sandstorm Kendall, Nev	Feb. 21	Mar. 27	0.01
Silver Moon, Ida	Feb. 26	Mar. 22	0.005
Silver Mountain, Ida	Feb. 17	Mar. 17	0.002
Silver Pick Con., Nev	Feb. 28	Apr. 3	0.01
Sixes Min., Nev	Mar. 17	Apr. 1	0.10
Snowshoe, Ida	Feb. 15	Mar. 15	0.005
Summit Ex., Utah	Mar. 15	May 1	0.01
Sunset, Nev	Mar. 27	Apr. 29	0.01
Tintic Milling, Utah	Mar. 14	Apr. 3	0.03
Tintic Standard, Utah	Mar. 15	Apr. 10	0.005
Tono, Gypsy Qn., Nev	Mar. 20	Apr. 24	0.01
Utah Metals, Utah	Mar. 11	Apr. 15	0.001
Utah-United, Utah	Mar. 10	Mar. 30	0.01
Uvada, Nev	Feb. 21	Mar. 20	0.02
West Toledo, Utah	Mar. 6	Mar. 22	0.01

Stock Quotations

COLO. SPRINGS Mar. 7		SALT LAKE Mar. 7	
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.04½	Beck Tunnel	.18
Crippie Cr'k Con	.007	Black Jack	.13
Dante	.02	Colorado Mining	.23
Doctor Jack Pot	.10½	Crown Point	.06
Elkton Con	.32½	Daly-Judge	8.35
El Paso	.81	Emma Cop	.66
Findlay	.04½	Gold Chain	.30
Gold Dollar	.02	Grand Central	.78
Gold Sovereign	.04½	Iron Blossom	1.67½
Golden Cycle	2.03½	Lower Mammoth	.06½
Isabella	.25½	May Day	.17½
Jack Pot	.06½	Opohongo	.03
Jerry Johnson	.05	Prince Con	1.15
Levington	‡.005	Seven Troughs	.01½
Mary McKinney	.45½	Silver King Coal'n	3.45
Pharmacist	.009	Silver King Con	2.60
Portland	1.85	Sioux Con	.10
Raven B. H.	.01	Uncle Sam	.09
Vindicator	2.40	Yankee	.30

SAN FRANCISCO Mar. 7			
Alta	.05	Belmont	4.25
Andes	.06	Jim Butler	.88
Best & Belcher	.03	Lone Star	.02
Caledonia	.32	MacNamara	.08
Challenge Con	.05	Midway	.15
Chollar	‡.02	Mont.-Tonopah	.24
Confidence	‡.15	North Star	.15
Con. Virginia	.08	Rescue Eula	.24
Gould & Curry	.01	West End Con	.70
Hale & Norcross	.03	Atlanta	.16
Jacket-Cr. Pt	.11	Blue Bell	.02
Julia	‡.01	Booth	.32
Mexican	.18	C.O.D. Con	.03
Occidental	.75	Comb. Frac	.07
Ophir	.18	D'field Daisy	.02
Overman	.05	Jumbo Extension	.92
Savage	.04	Pitts.-Silver Peak	.07
Seg Belcher	.03	Round Mountain	.60
Sierra Nevada	.32	Sandstorm Kendall	.06
Union Con	.46	Silver Pick	.07
Utah Con	.02	Central Eureka	.12

TORONTO Mar. 7			
Bailey	.05½	Dome Exten	.35
Chambers Feriand	.22½	Dome Lake	.24½
Coniagas	3.87½	Foley O'Brien	.50
La Rose	.60	Hollinger	26.75
Peterson Lake	.26½	Imperial	‡.03½
Right of Way	.05	Jupiter	.21½
Seneca Superior	.48	McIntyre	.92½
T. & Hudson Bay	26.00	Porcu. Crown	‡.75
Temiskaming	.54	Preston E. D	.04½
Trethewey	.12	Vipond	.55
Wettlaufer-Lor	.08	West Dome	.14½

LONDON Feb. 23			
Alaska Treadwell	£6 12s 6d	Mexico Mines	£3 13s 9d
Burma Corp	1 14 0	Nechi, pfd	0 13 6
Cam & Motor	0 12 0	Oroville	0 13 6
Camp Bird	0 7 0	Santa Gert'dis	‡0 10 6
El Oro	0 8 0	Tomboy	1 1 6
Esperanza	‡0 9 6	Tough Oakes	0 12 6

N. Y. EXCH. Mar. 7		BOSTON EXCH Mar. 7	
Name of Comp.	Clg.	Name of Comp.	Bid
Alaska Gold M	18	Adventure	2
Alaska Juneau	8½	Ahmeek	401½
Am.Sm.&Ref.,com	100	Algomah	1½
Am. Sm. & Ref., pf.	111½	Allouez	72
Am. Sm. Sec., pf. A	92½	Ariz. Com., ctfs	8½
Am. Sm. Sec., pf. B	86½	Bonanza	‡.35
Am. Zinc	81½	Butte Alex. Scott	10½
Anaconda	86¾	Butte-Balaklava	4½
Batopilas Min	2	Calumet & Ariz	72
Bethlehem Steel	476½	Calumet & Hecla	555
Bethlehem Steel, pf	131	Centennial	16½
Butte & Superior	97½	Copper Range	64
Chile Cop	22½	Daly West	2½
Chino	57½	East Butte	13½
Colo. Fuel & Iron	42	Franklin	9½
Crucible Steel	81½	Granby	91
Dome Mines	24½	Hancock	16½
Federal M. & S	28	Hedley	24
Federal M. & S., pf	54	Helvetia	.50
Great Nor., ore., ctf	42	Indiana	5
Greene Cananea	49½	Island Cr'k, com	‡45½
Guggen. Exp	21	Island Cr'k, pfd	90
Homestake	130	Isle Royale	28
Inspiration Con	46½	Keweenaw	3½
International Nickel	45½	Lake	16½
Kennecott	57½	La Salle	4½
Lackawanna Steel	75½	Mason Valley	3
Miami Copper	36	Mass	13½
Nat'l Lead, com	67½	Mayflower	3½
National Lead, pf	113	Michigan	1½
Nev. Consol	16½	Mohawk	93½
Ontario Min	7½	New Arcadian	8½
Quicksilver	4½	New Idria	19½
Quicksilver, pf	6½	North Butte	29½
Ray Con	24½	North Lake	1½
Republic I&S, com	51½	Ojibway	1½
Republic I&S, pf	111½	Old Colony	2½
Sloss-Sheffield	55	Old Dominion	72
Sloss-Sheffield, pf	94	Osceola	95½
Tennessee Copper	56½	Quincy	92½
Utah Copper	85½	St. Mary's M. L	70½
U. S. Steel, com	82½	Santa Fe	3½
U. S. Steel, pf	116½	Shannon	10½
Va. Iron C. & C	52	Shattuck-Ariz	37
		So. Lake	6½
N. Y. CURB Mar. 7		So. Utah	.25
Alta Con	.24	Superior	18½
Beaver Con	.36	Superior & Bost	3½
Big Four	‡.04	Tamarack	53
Buffalo Mines	⅜	Trinity	9
Butte & N. Y	3½	Tuolumne	.17
Butte C. & Z	7½	U. S. Smelting	64
Can. Cop. Corpn	1 1/16	U. S. Smelt'g, pf	50½
Cashboy	.04	Utah Apex	4½
Cerro de Pasco	38½	Utah Con	14½
Con. Ariz. Sm	1 7/16	Victoria	3½
Con. Coppermines	1 13/16	Winona	4½
Con. Nev.-Utah	⅛	Wolverine	65½
Dia. Black B	.02	Wyandot	1½
First Nat. Cop	6		
Florence	.45	BOSTON CURB Mar. 7	
Goldfield Con	.91	Bingham Mines	11
Goldfield Merger	.14½	Boston Ely	.35
Hecla Min	4 1/16	Butte & Lon'n Dev	.67
Howe Sound	5½	Calaveras	3
Kerr Lake	3½	Calumet-Corbin	.04
Magma	17½	Chief Con	1½
Majestic	1	Cortez	.60
McKinley-Dar-Sa	.45	Crown Reserve	.40
Mines of Am	2½	Davis-Daly	1 1/16
Mother Lode	.29	Eagle & Blue Bell	1½
Nevada Hills	.23	Houghton Copper	2½
New Utah Bingham	4½	Iron Cap Cop., pf	6
Nipissing Mines	6½	Mexican Metals	.46
Oro	.04½	Mojave Tungsten	6½
Ray Hercules	3½	Nat. Zinc & Lead	2½
Rochester Mines	.55	Nevada-Douglas	1
St. Joseph Lead	15½	New Baltic	3
Stand'd Oil of N.J.	513	New Cornelia	11½
Standard S. L	1½	Ohio Copper	.18
Stewart	.28	Oneco	1½
Success	.93	Raven Copper	.18
Tonopah	6½	Rex Cons	.17
Tonopah Ex	4½	Rilla	1
Tonopah Merger	.60	United Verde Ext	16
Tribullion	⅛	Utah Metal	9½
White Knob, pf	1½		
Yukon Gold	2½	‡Last Quotations.	

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1914	1915	1916	1914	1915	1916
January	56.572	48.855	56.775	26.553	22.731	26.953
February	57.506	48.477	56.755	26.573	22.753	26.975
March	58.067	50.241		26.788	23.708	
April	58.519	50.250		26.958	23.709	
May	58.175	49.915		26.704	23.570	
June	56.471	49.034		25.948	23.267	
July	54.678	47.519		25.219	22.597	
August	54.344	47.163		25.979	22.780	
September	53.290	48.680		24.260	23.591	
October	50.654	49.385		23.199	23.925	
November	49.082	51.714		22.703	25.094	
December	49.375	54.971		22.900	26.373	
Year	54.811	49.604		27.314	23.675	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic		London Standard		London Electrolytic	
	1915	1916	1915	1916	1915	1916
Jan	13.641	24.008	60.756	88.083	65.719	116.17
Feb	14.394	26.440	63.494	102.667	*	133.167
Mar	14.787		66.152		*	
April	16.811		75.096		*	
May	18.506		77.600		*	
June	19.477		82.574		95.333	
July	18.796		76.011		91.409	
Aug	16.941		68.673		82.333	
Sept	17.592		68.915		85.250	
Oct	17.686		72.601		88.000	
Nov	18.627		77.744		93.273	
Dec	20.133		80.773		100.43	
Year	17.275		72.532			

TIN

Month	New York		London	
	1915	1916	1915	1916
January	34.260	41.825	156.550	175.548
February	37.415	42.717	176.925	181.107
March	48.426		180.141	
April	47.884		166.225	
May	38.790		162.675	
June	40.288		167.636	
July	37.423		167.080	
August	34.389		151.440	
September	33.125		152.625	
October	33.080		151.554	
November	39.224		167.670	
December	38.779		167.000	
Av. year	38.500		163.960	

LEAD

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
January	3.729	5.921	3.548	5.826	18.606	31.167
February	3.827	6.246	3.718	6.164	19.122	31.988
March	4.053		3.997		21.883	
April	4.221		4.142		21.094	
May	4.274		4.182		20.347	
June	5.932		5.836		25.170	
July	5.659		5.531		24.611	
August	4.656		4.520		21.946	
September	4.610		4.490		23.151	
October	4.600		4.499		23.994	
November	5.155		5.078		26.278	
December	5.355		5.266		28.807	
Year	4.628		4.587		22.917	

SPELTER

Month	New York		St. Louis		London	
	1915	1916	1915	1916	1915	1916
Jan	6.386	16.915	6.211	16.745	30.844	89.810
Feb	8.436	18.420	8.255	18.260	39.819	97.762
Mar	8.541		8.360		44.141	
April	10.012		9.837		49.888	
May	14.781		14.610		68.100	
June	21.208		21.038		100.614	
July	19.026		18.856		97.250	
Aug	12.781		12.611		67.786	
Sept	13.440		13.270		67.841	
Oct	12.800		12.596		66.536	
Nov	15.962		15.792		88.409	
Dec	15.391		15.221		89.400	
Year	13.230		13.054		67.553	

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton. * Not reported.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1915	1916	1915	1916	1915	1916
January	$14.59	$21.60	$13.45	$18.78	$13.90	$19.70
February	14.55	21.16	13.45	18.93	13.90	19.51
March	14.55		13.45		13.95	
April	14.55		13.45		13.95	
May	14.64		13.60		13.83	
June	14.70		13.67		13.77	
July	14.94		13.91		13.68	
August	16.01		15.31		14.75	
September	16.86		15.95		15.70	
October	16.95		15.96		15.80	
November	18.26		17.30		17.20	
December	19.95		18.95		18.95	
Year	$14.89		$13.76		$13.89	